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One of the largest skyscrapers in New York City will have a main artery of automobile traffic running right through the building.

Safety Plane for Ocean Trips

A brand new invention of a safety plane for trans-oceanic flying. This plane can travel over land or water, and in case of disablement at sea, the passenger cabin becomes a boat.

Automatic Servant

Remarkable new automaton may solve servant problem.

The "Finger Prints" that Guns Leave

Some remarkable new evidence on how the criminal's gun leaves tell-tale marks behind.

CONTENTS OF THIS NUMBER

Editorial ... *By Hugo Gernsback*	693
Hands Create Radio Music ... *By H. Winfield Secor*	694
A Tree Menagerie	695
Huge All-metal European Planes	696
Over Niagara Falls for Movie Comedy ... *By Edwin Schallert*	698
Scientific Advances in 1927 Toyland	700
Huge Telescope to Probe Sky ... *By W. J. Luyten, of the Harvard College Observatory*	702
Ore Located by Seismograph	704
If We Had No Ears ... *By Joseph H. Kraus*	704
New Machine Charts Fatigue ... *By F. G. Bailey*	705
Third Dimensional Movie Screen	705
The Metal Emperor—Third Installment ... *By A. Merritt*	706
Can You Answer These Scientific Questions?	708
The Month's Scientific News Illustrated ... *By George Wall*	709
Everyday Chemistry ... *By Raymond B. Wailes*	710
Magic—A Monthly Feature ... *By Dunninger*	711
Motor Hints ... *Conducted by George A. Luers, Automotive Expert*	712
Making a Martha Washington Sewing Cabinet ... *By Harry W. Beckwith*	713
Model Department—Building a Model of the U. S. Brig of War "Truxton" ... *By William A. Crosby*	714
Experimental Electrics—A Handy Battery Motor ... *By A. Latham*	716
Experimental Chemistry ... *Edited by Dr. T. O'Conor Sloane*	717
The Constructor—Photographing The Sun Without a Telescope ... *By Donald H. Menzel*	718
Hints for the Mechanic Department	719
How-to-Make-It	720
Readers Forum	721
Wrinkles, Recipes and Formulas ... *Edited by S. Gernsback*	722
Our Part in Ruth Elder's Flight	723
A One Tube A. C. Receiver	724
A New Nine Tube Loop Set	726
Radio Oracle	727
Scientific Humor	728
Latest Patents	729
Oracle	730
Patent Advice	738
Book Review	**765**

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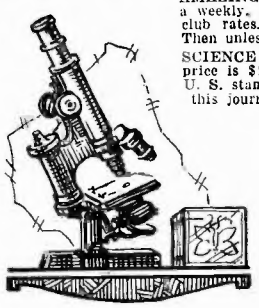

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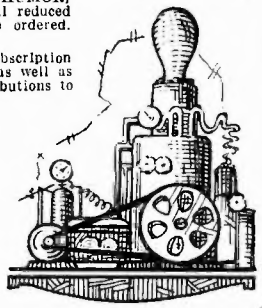

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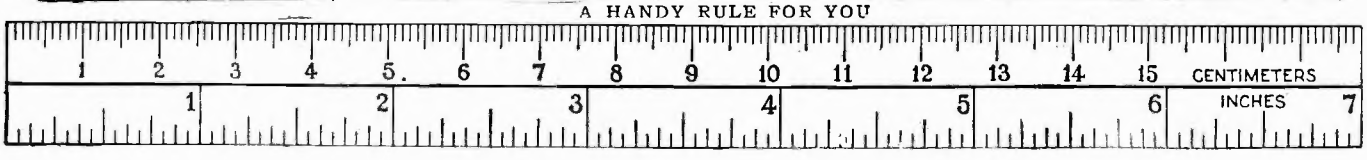

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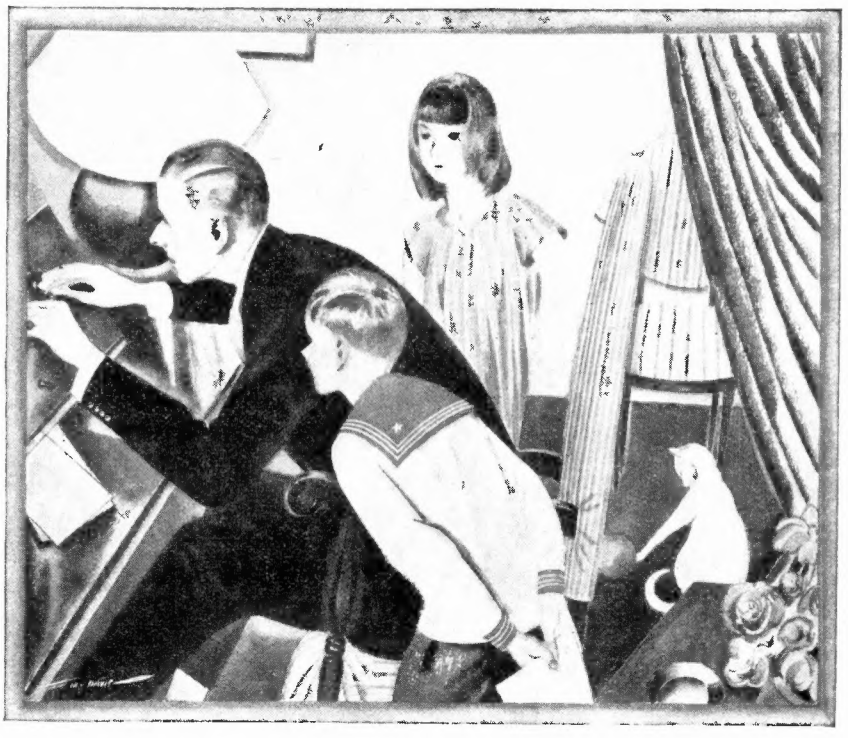
Here is the Eveready Layerbilt "B" Battery No. 486, Eveready's longest-lasting provider of Battery Power.



Radio is better with *Battery* Power

TURN your radio dial, and presto! you turn your home into a theater, a concert hall, a lecture room, a cabaret, a church, or whatever you will. Turn the dial and your attentive ear does the rest. That is all there is to this magic of radio.

Or almost all. If a radio set is to work at its very best, attracting no attention to itself, creating for you the illusion that can be so convincing, you must pay a little attention to the kind of power you give it. There is but one direction, a simple one—use Battery Power. Only such power is steady, uniform, silent. It is called by scientists pure Direct Current. Any other kind of current in your radio set may put a hum into the purest note of a flute, a scratch into the song of the greatest singer, a rattle into the voice of any orator.

Don't tamper with tone. Beware of interfering with illusion. Power that reveals its presence by its noise is like a magician's assistant who gives the trick away. Use batteries—use the Eveready Layerbilt "B" Battery No. 486, the remarkable battery whose exclusive, patented construction makes it last longest. It offers you the gift of convenience, a gift that you will appreciate almost as much as you will cherish the perfection of reception that only Battery Power makes possible.

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WSB—*Atlanta*
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9 P. M., Pacific Standard Time

KPO—KGO—*San Francisco*
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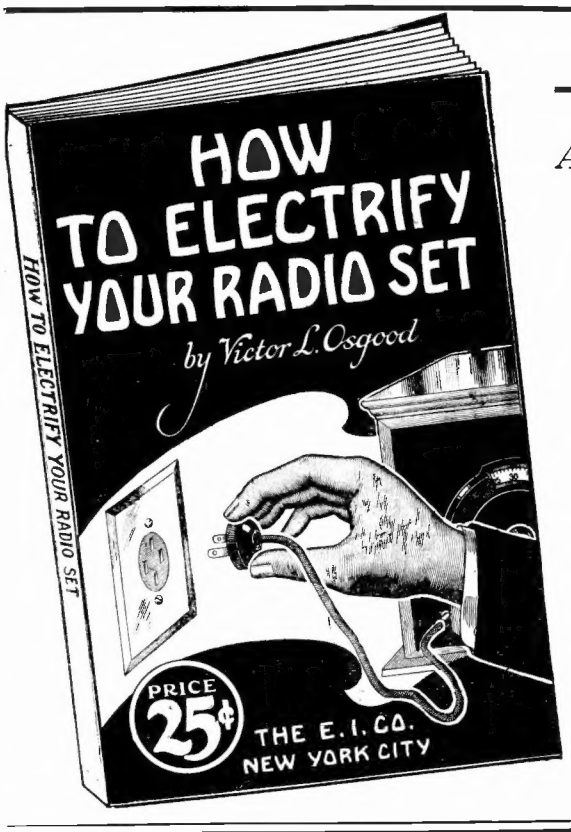
KGW—*Portland*

The air is full of things you shouldn't miss

INDEX TO ADVERTISERS

	Page
A	
American Auto & Radio Mfg. Co. 744, 756, 757, 762, 764,	768
American Chime Clock Company	741
American Detective System	764
American Radio Hardware Company	747
American School	681
American School of Aviation	735
American School of Music	755
American School of Photography	755
American Society for Promotion of Aviation	766
American Telephone & Telegraph Co.	745
Anita Company	742
Audel & Company, Theo.	Inside Back Cover
Automatic Rubber Company	763
Aviation Institute of U. S. A.	764
B	
B. C. L Radio Service Co., Inc.	748
Balda Art Service	763
Bathe Mfg. Co.	734
Battle Stories	688
Bell Perfume Company	749
Bernard & Heller	740
Blancke Auto Devices Co.	751
Bliss Electrical School	742
Boeing, M. L.	761
Bogue, B. N.	756
Book Supply Company, The	753
Buescher Band Instrument Co.	744
Bureau of Inventive Science	740
C	
Carlson Cartoon Service	747
Cervenec System, A. S.	765
Chemical Institute of New York	686
Chicago Correspondence School of Music, Inc.	754
Chicago Solder Co.	766
Clarkson, David B.	748
Coleman, Watson, E.	740
Conn, Ltd., C. G.	750
Consrad Co., Inc. 748, 752, 754, 756, 758, 760,	770
Consumers Radio Company	736
Cooke School of Electricity, L. L.	691
Coyne Electrical School	685
Cushing, H. C. Jr.	762
D	
Dobe Drafting Service	767
Douglas, Lyle	755
Dryer, Prof. J. A.	773
E	
Electro Magnetic Tool Co.	742
Elite Jewelry House	754
Engineers Service Co.	Back Cover
Evans, Victor J. & Co.	741
F	
Farmer Burns School	763
Ferry & Company 765,	768
First Hawaiian Conservatory of Music	763
Fisher Mfg. Co., Adam	740
Franklin Institute 749,	758
Franklin Publishing Co.	768
G	
Gaston Mfg. Co.	750
Gerold Co., The	732
Gilbert Co., A. C., The	692
Gilson Slide Rule Co.	734
Givens, E. S.	766
H	
Hardin-Lavin Co.	764
Haywood Tire Co.	764
High Frequency Laboratories	742
Hobart Bros. Co. 732,	745
Hoenack, Paul	740
Holton & Co., Frank	773
I	
Ideal Aeroplane & Supply Co.	758
Inkograph Company, Inc.	750
International Correspondence Schools 756, 760, 764,	766
International Typewriter Exchange	753
Inventors Service Bureau	740
Irwin Aircraft Co.	767
J	
Jiffy Glass Cleaner Co., The	751
K	
Karol & Sons Co., B.	772
Kelsey Co., The	768
Kennedy, R. M.	764
L	
Laboratory Materials Co.	766
Lacey & Lacey	738
Lancaster & Allwine	740
LaSalle Extension University	772
Lederer School of Drawing	767
Le Page's Craft League	751
Leonard, A. O.	761
LeRoy, William	766
Liederman, Earle E.	763
Liggett & Myers Tobacco Co.	753
Loftis Brothers & Co.	762
Long-Eakins Co.	763
Mc	
McGraw-Hill Book Co., Inc.	737
M	
Magic Shop, The	752
Marwood Radio Corp.	747
Maxson, F. P.	732
Meccano Co., Inc.	736
Metal Arts, Co., Inc.	768
Metal Cast Products Co.	767
Middleton, John	757
Midwest Radio Corp'n.	771
Miller, Monroe E.	740
Miniature Ship Models, Inc. 731,	757
Movie Operators School	732
Munn & Company	738
N	
Nassau Hotel	750
National Carbon Co., Inc.	683
National Electrical School	751
National Radio Institute	687
National School of Cartooning, The	762
National Tuberculosis Ass'n.	734
Nestler Rubber Fusing Co., Inc.	773
New Method Mfg. Co.	762
New York Academy of Music 736,	761
New York Electrical School	755
New York Institute of Photography	760
N. W. School of Taxidermy	768
Norton Institute	764
O	
O'Brien, Clarence A.	739
Ogilvie Publishing Co. 753,	767
Owen, Richard B.	740
Ozment, C. J. 736,	762
P	
Parker, C. L.	740
Parks Woodworking Machine Co.	732
Pathfinder Publishing Co.	768
Patterson, A. R.	752
Penn Merchandise Co., Inc.	772
Plymouth Rock Squab Co.	751
Polk & Co., R. L.	766
Polachek, Z. H.	740
Popular Chemistry	755
Porter Chemical Co., The	753
Press Guild, The	734
Publishers Classified Service, The	769
R	
Radio Association of America	744
Radio Equipment Co.	765
Radio Power Co.	765
Radio Specialty Co.	776
Randolph Radio Corp.	Inside Front Cover
Randolph & Co.	738
Ross-Gould Co.	768
Rumsey, C. L.	761
S	
S. Service	761
School of Engineering of Milwaukee	744
Shipman-Ward Mfg. Co.	762
Spors & Co., F.	764
Sportsman's Digest	767
Standard Business Training Institute	764
Sterling Diamond & Watch Co.	768
Stern Audit Co.	760
Strongfort Institute	765
T	
Tamblyn, F. W.	773
Tarbell System, Inc.	689
Townsend Laboratories	751
Treasure Sales Co.	762
U	
United Electric Motor Co.	748
Universal Plumbing School	732
Up-to-Date Machine Works	733
University of Applied Science	761
U. S. Swiss Agents	748
V	
Van Deventer, H. R.	738
W	
Waco Tool Works, Inc.	757
Washington School of Art	773
Washington School of Cartooning	732
Washington Show Card School	768
Weiler, Jason & Sons	767
Whirlwind Carburetor Co.	736

Electrify!—Your Radio Set



—at home!!

All about Electrification and "How to Build" latest apparatus explained in NEW BOOK

What is Electrification? Why is it now being used on all modern Receivers? How can it be adapted to my set? How can I *build* a satisfactory unit to electrify my set?

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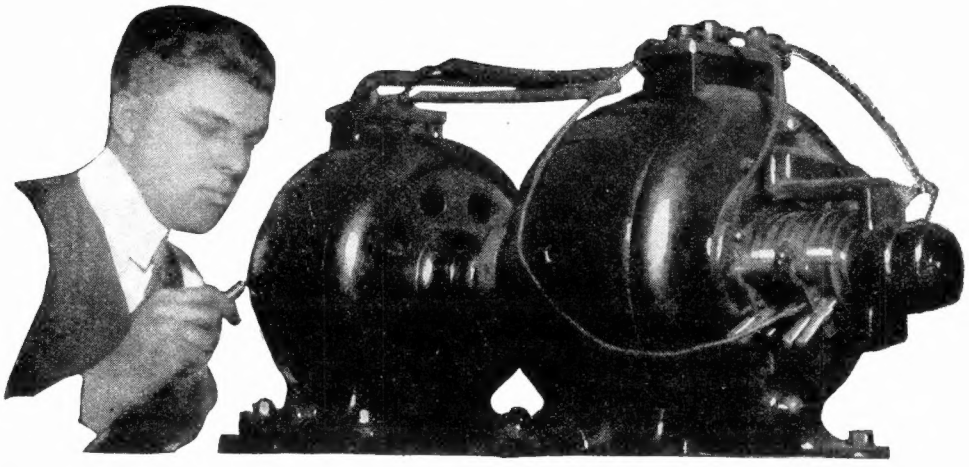

Amazingly Easy Way to get into ELECTRICITY

Don't spend your life waiting for $5 raises in a dull, hopeless job. Now . . . and forever . . . say good-bye to 25 and 35 dollars a week. Let me show you how to qualify for jobs leading to salaries of $50, $60 and up, a week, in Electricity—NOT by correspondence, but by an amazing way to teach, that makes you a practical expert in 90 days! Getting into Electricity is far easier than you imagine!

Learn Without Lessons in 90 DAYS

LACK of experience—age, or advanced education bars no one. I don't care if you don't know an armature from an air brake—I don't expect you to! I don't care if you're 16 years old or 40—it makes no difference! Don't let lack of money stop you. Most of the men at Coyne have no more money than you have.

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Many of my students earn a good part or all of their expenses and should you need this assistance we will help you. Then, in 12 brief weeks, in the great roaring shops of Coyne, I train you as you never dreamed you could be trained . . . on the greatest outlay of electrical apparatus ever assembled . . . costing hundreds of thousands of dollars . . . real dynamos, engines, power plants, autos, switchboards, transmitting stations . . . everything from doorbells to farm power and lighting . . . full-sized . . . in full operation every day!

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Anto Electrician
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Inventor - - Unlimited
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$60 a Week and up
Radio Expert, $60 a Week and up

No Books—No Lessons

No books, no lessons . . . all real actual work . . . building real batteries . . . winding real armatures, operating real motors, dynamos and generators, wiring houses, etc., etc. That's a glimpse of how we make you a master practical electrician in 90 days, teaching you far more than the average ordinary electrician ever knows and fitting you to step into jobs leading to big pay immediately after graduation. Here, in this world-famous *Parent school* —and nowhere else in the world—can you get such training!

Jobs, Pay, Future

Don't worry about a job, Coyne training settles the job question for life. Demand for Coyne men often exceeds the supply. Our employment bureau gives you lifetime service. Two weeks after graduation, Clyde F. Hart got a position as electrician with the Great Western Railroad at over $100 a week. That's not unusual. We can point to Coyne men making up to $600 a month. Coyne men get positions which lead to salaries of $50.00, $60.00 and up a week. You can go into radio, battery or automotive electrical business for yourself and make *from $3000 a year up.*

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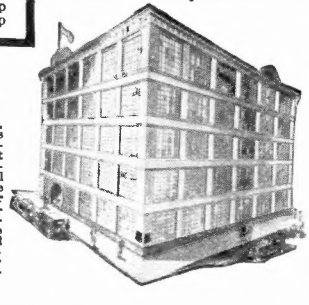

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H. C. LEWIS, President, Dept. 97-83
500 S. Paulina St., Chicago **Established 1899**

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Gentlemen: I must tell you the success I have had since taking your chemistry course. My salary has been increased several times, and different industrial plants are coming to me for a little advice on different things, netting me a fair side income.

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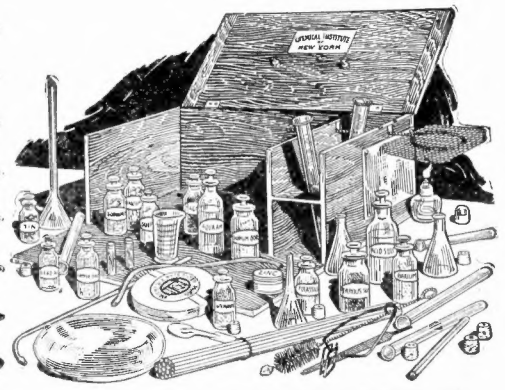

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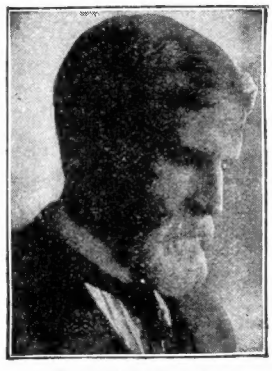

T. O'CONOR SLOANE,
A.B., A.M., LL.D., Ph.D.

Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

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Besides furnishing the student with his Experimental Equipment, we are making an additional special offer for a short while only. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

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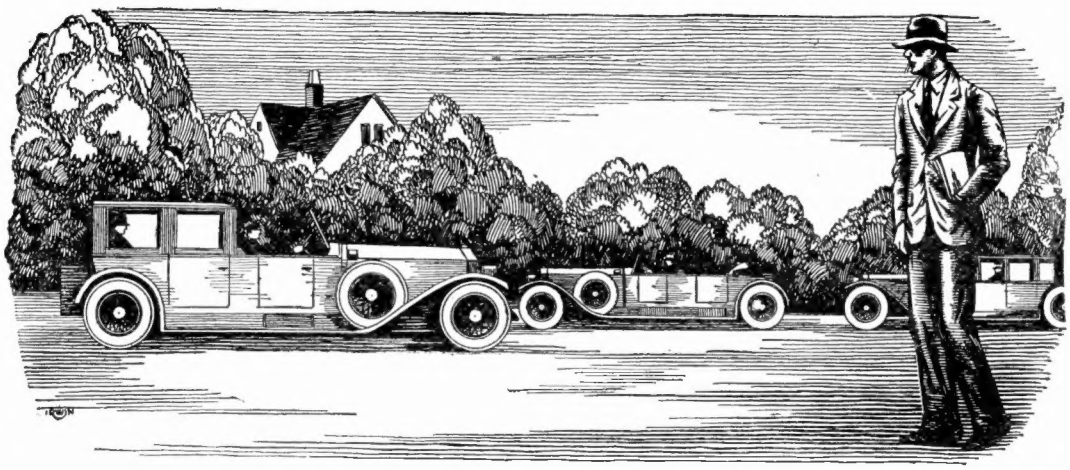

Many times in the old days, while I trudged home after work to save carfare, I used to gaze enviously at the shining cars gliding by me, the prosperous men and women within. Little did I think that inside of a year, I, too, should have my own car, a decent bank account, the good things of life that make it worth living.

I Thought Success Was For Others

Believe It Or Not, Just Twelve Months Ago I Was Next Thing To "Down-and-Out"

TODAY I'm sole owner of the fastest growing Radio store in town. And I'm on good terms with my banker, too—not like the old days only a year ago, when often I didn't have one dollar to knock against another in my pocket. My wife and I live in the snuggest little home you ever saw, right in one of the best neighborhoods. And to think that a year ago I used to dodge the landlady when she came to collect the rent for the litle bedroom I called "home"!

It all seems like a dream now, as I look back over the past twelve short months, and think how discouraged I was then, at the "end of a blind alley." I thought I never had had a good chance in my life, and I thought I never would have one. But it was waking up that I needed, and here's the story of how I got it.

I WAS a clerk, working at the usual miserable salary such jobs pay. Somehow I'd never found any way to get into a line where I could make good money.

Other fellows seemed to find opportunities. But—much as I wanted the good things that go with success and a decent income—all the really well-paid vacancies I ever heard of seemed to be out of my line—to call for some kind of knowledge I didn't have.

And I wanted to get married. A fine situation, wasn't it? Mary would have agreed to try it—but it wouldn't have been fair to her.

Mary had told me, "You can't get ahead where you are. Why don't you get into another line of work somewhere that you can advance?"

"That's fine, Mary," I replied, "but *what* line? I've always got my eyes open for a better job, but I never seem to hear of a really good job that I can handle." Mary didn't seem to be satisfied with the answer, but I didn't know what else to tell her.

It was on the way home that night that I stopped off in the neighborhood drug store, where I overheard a scrap of conversation about myself. A few burning words that were the cause of the turning point in my life!

With a hot flush of shame I turned and left the store, and walked rapidly home. So that was what my neighbors—the people who knew me best—really thought of me!

"Bargain counter sheik—look how that suit fits," one fellow had said in a low voice. "Bet he hasn't got a dollar in those pockets." "Oh, it's just 'Useless' Anderson," said another. "He's got a wish-bone where his backbone ought to be."

As I thought over the words in deep humiliation, a sudden thought made me catch my breath. Why had Mary been so dissatisfied with my answer that "I hadn't had a chance?" *Did Mary secretly think that too?* And after all, wasn't it *true* that I had a "wish-bone" where my back-bone ought to be? Wasn't that why I never had a "chance" to get ahead? It was true, only too true—and it had taken this cruel blow to my self-esteem to make me see it.

With a new determination I thumbed the pages of a magazine on the table, searching for an advertisement that I'd seen many times but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

WHAT'S happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months, *I've had a Radio business of my own!* At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance!"

NOW I'm making real money. I drive a good-looking car of my own. Mary and I don't own the house in full yet, but I've made a substantial down payment, and I'm not straining myself any to meet the installments.

Here's a real tip. You may not be as bad off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be *doing* something about it instead of drifting.

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. PD-6, Washington, D. C.

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Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

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To all outward appearances, bursting shells held no terror for him. He went on writing his letter as unconcernedly as though a war never existed.

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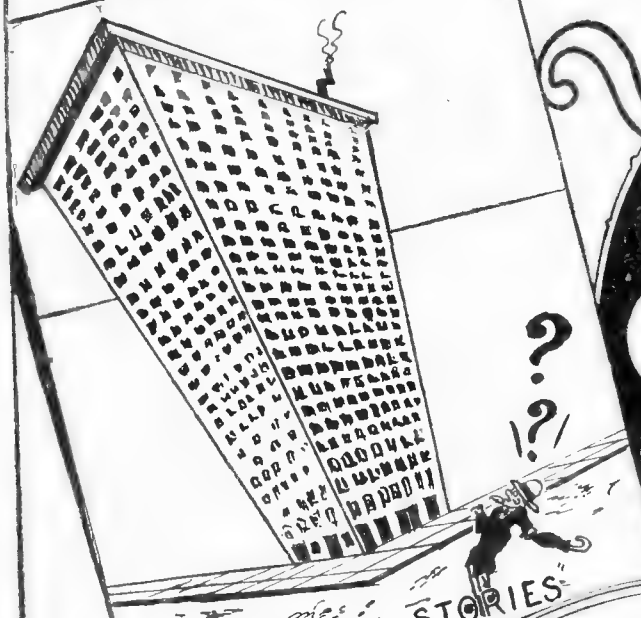
What is a COOKOO NUT?



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A COOKOO NUT is a new wrinkle to pass away your time. Far more interesting, more entertaining and more humorous than a cross-word puzzle. The COOKOO NUT illustrates an ordinary, well-known saying in a distinctly new manner. Study the examples on this page. The test of a COOKOO NUT is that there must be no question as to the correctness of the description. The quotation must absolutely fit the COOKOO NUT, otherwise it does not go. Cover up the captions of the COOKOO NUTS on this page, and make your friends guess what each COOKOO NUT stands for. An exciting new game is to play COOKOO NUTS at parties where everyone is asked to make up an original COOKOO NUT. The most mirth-provoking one gets the party prize.
The best COOKOO NUT printed in FRENCH HUMOR gets a weekly prize of $5.00. For every other one accepted FRENCH HUMOR pays $1.00.

"DESIRE UNDER THE ELMS"

"A SOCK IN THE EYE"

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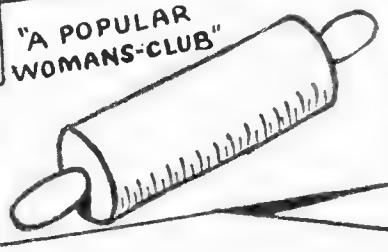
"SWEETIES"

"A POPULAR WOMANS-CLUB"



"PERIOD FURNITURE"

"A HOLE IN ONE" 1

See

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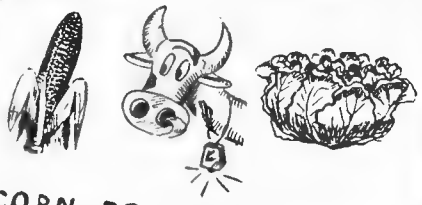

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YOU FELLOWS WHO WANT BIG PAY

Get Into ELECTRICITY

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Dear Mr. Cooke:
I was making $25 a week when I enrolled. Now, with my own Electrical Shop I make as high as $30 a day.
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$1.50 AN HOUR
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I had to work like a slave for 15c an hour before I enrolled. Now, thanks to you, Mr. Cooke, I make $1.50 an hour.
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WHY earn $15 or $20 or $30 a week, when in the same six days as an Electrical Expert, you can make $70 to $200—and do it easier—not work half so hard. Why, then, remain in a small-pay, no-future job that offers no chance for big promotion—no chance for big income? Fit yourself for a real job. Get into Electricity. That's where the big money is being made, and always will be made.

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To learn Electricity my way you don't have to be a College man, or even a High School graduate. You can read. You can write. That's enough. With me, you get experience as you go along and make good money while learning. I'll show you how—and I'll give you, without extra cost, tools and apparatus to work with—6 Big Outfits in all.

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That's what I agree to do. And back of me in this agreement stands the Chicago Engineering Works, a $2,000,000 Illinois Corporation. There's nothing like "Cooke" Training, anywhere. It's the Training that big Electrical men are praising; it's the Training that employers recommend; it's the Training that one of our greatest Engineering societies has endorsed 100 per cent. It's the Training for you.

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with these sensational new features

1—Complete Unit Control (New assembled Trumodel Construction equipment parts)
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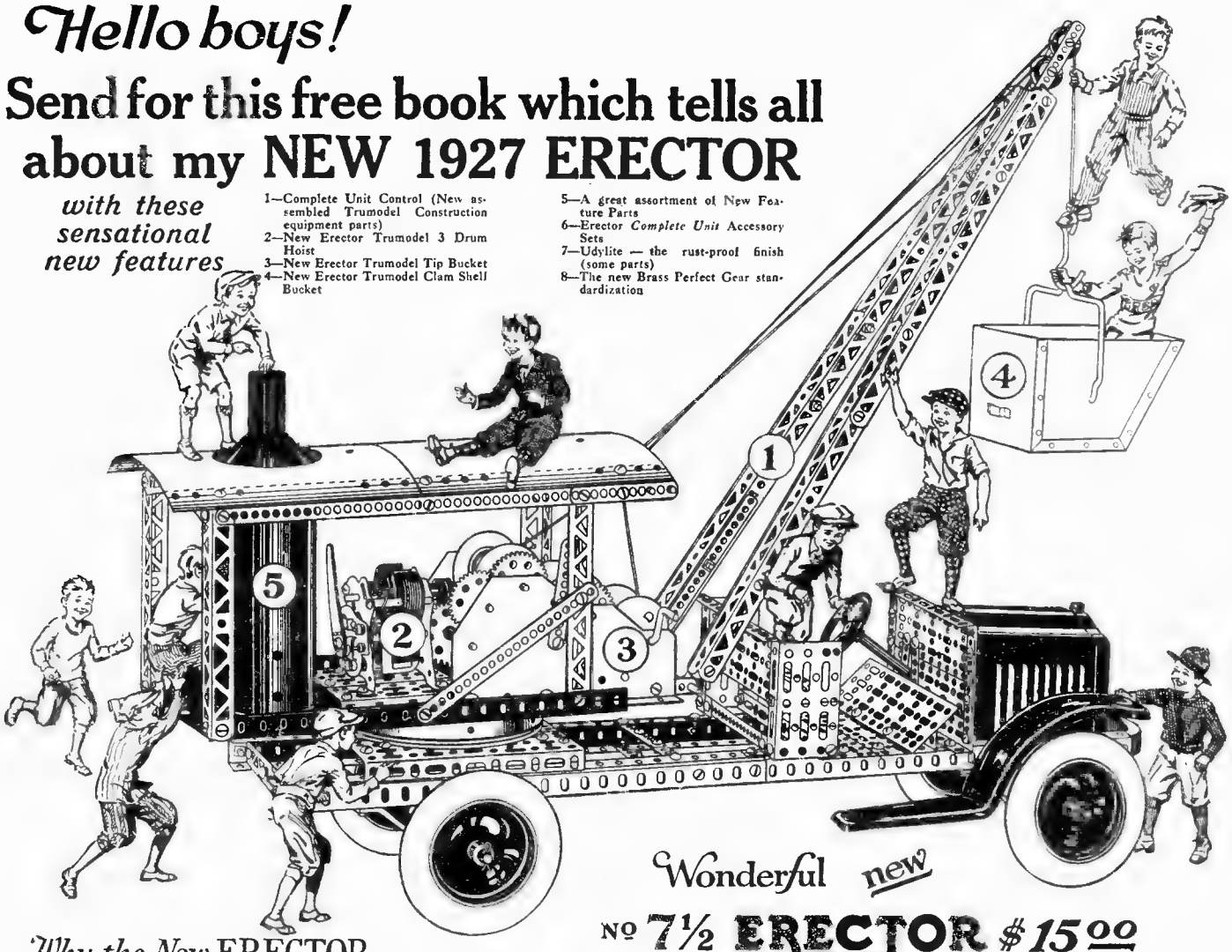

Wonderful new No 7½ ERECTOR $15.00

With Automobile Chassis

Here's the set I know will give you the greatest thrill you ever had. Fun! Oh, Boy! It's the real thing, and there's a thrill packed in every one of its 627 parts. Boys, in this great outfit there are hours of real sport waiting for you building automotive models. From this great assortment of distinctive, important and feature Erector parts you can build 554 models—wonderful automobile chassis, tractors, scooters, service cars, fire engines, hook and ladder, are only a few.

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Why the New ERECTOR *is the world's greatest toy*

Trumodel Features:

1. ERECTOR SQUARE GIRDER. This big, exclusive Erector feature makes Erector so sturdy and strong. They are real girders just like engineers use in making skyscrapers and bridges. (In all Erector Sets.)
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3. 3-DRUM HOIST. Completely assembled operating unit. New exclusive Erector feature. (In the No. 8 Erector and up.)
4. TIP BUCKET. An exclusive Erector feature. (In the No. 8 and up.)
5. ERECTOR STEAM BOILER. There is no end to the models that this exclusive Erector feature makes possible. Hoisting engine, steamboats, fire engine, horizontal engine, locomotives. The Erector motor furnishes power to make these models go. (In the Super No. 7 and up.)

OTHER COMPLETE UNIT CONTROL PARTS MOTORIZED FEATURES, ARE:

Large solid steel disc wheels with balloon tires, chassis, genuine fenders, hood, bumper, truck body, steering wheel, steering knuckle, front axle, springs. (All in the No. 7½ Erector and up.)

Other Erector Features

1. Erector contains more parts and builds more models than any other construction toy.
2. The New Erector Steam Shovel—an exclusive Erector feature. (In Super Erector No. 7 and up.)
3. The New Erector Dredge Bucket—an exclusive Erector feature. (In the New No. 10.)
4. Curved Erector Girders. An exclusive Erector feature. (In all sets.)
5. Giant Fly Wheel. An exclusive Erector feature. In the No. 10 Set.
6. Perforated Strips—four holes to the inch.
7. New brass perfect gear standardization. The New Erector contains a great assortment of brass and die-cast gears, including pinion, crown gears, flat gears, mitre gears, and a large 72-tooth gear.

A FEW OF THE MANY NEW 1927 FEATURE PARTS ARE:

Boiler plate, bull ring, new Chain Bucket, Beam Girders Curved, Segment Plate, Ratchet—and hundreds of other genuine perfect mechanical parts for duplicating every engineering feat ever attempted. Possible with no other toy than the New Erector.

1. Erector is made from structural steel, plated enameled and electrically baked.
2. Designed by engineers, used by engineers and endorsed by engineers.
3. The Mechanical features of Erector are correct. It is the only correct method of reproducing engineering feats.
4. Perfectly interchangeable, owing to the minute details of standardization.

Boys! Here's the greatest book I ever compiled

In this book you will find the final story of my years of experience since I first invented Erector—the construction set which other engineers have been kind enough to call "the world's greatest toy"—and which they consider one of the most astonishing mechanical phenomena of the age.

In this book I tell you how with Erector's new Construction parts you can build and operate (one after the other) over 1000 actual working models of Aeroplanes, Submarines, Ocean liners, Light houses, Machine guns, Automobiles, Ship cranes, Trains, Steam shovels, Traveling crane, Wrecking hoist, Trench diggers, Locomotives, Hoisting derricks, Cantilever bridges, Suspension bridges, Well drillers, Power plants and Hoisting engines.

Think what a thrill you'll get making these wonderful working models whiz and hum with the powerful Erector electric motor. The day you get your Erector (Christmas or any other day) will be the biggest of your life. Send for my new book "Engineering Thrills" today and then tell your Dad. Don't miss this chance. Make him realize what you really want by showing him the book and then taking him to the nearest toy store to see for himself. He'll want to build models with Erector too. Just fill out the coupon below.

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Volume XV
Whole No. 176

Science and Invention

December, 1927
No. 8

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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

FAITH CURES

By HUGO GERNSBACK

THE President of a Western institution addresses me as follows:

"I am interested in having your opinion on a question arising out of your article in the October number of your magazine. The statement occurs under the sub-head, 'Cure due to mental attitude.' I have no opinion on the *Ionaco* device; knowing almost nothing about it. I wish an explanation by yourself on what you mean by FAITH. It is evident from your statement that you believe that FAITH cures a large percentage of people who exercise it. My question is, if faith heals as you say it does, HOW does it do it, and WHY?"

So-called *faith cures* have been known since the dawn of humanity. Faith cures are perhaps the strongest proof of the control of the mind over the body. History is full of shining examples of faith cures and many so-called miracles are all directly traceable to these mental influences. Astonishing faith cures can be found even today in most aboriginal tribes. Here the medicine men, by chants, incantations, or other hocus pocus, very often succeed in curing various diseases. Every medical doctor knows that a large percentage of patients can be cured or helped *only* if they believe in the doctor, that is, have faith in him. If you have no confidence in your doctor, most of his prescribed remedies will do little good. The greatest problem every doctor encounters is to gain the patient's confidence. Without that confidence he would be a mighty poor doctor.

Applied medicine can do a great amount of good, but the modern doctor must be a psychologist as well as a student of physiological chemistry. We all know of the imaginary sick man or woman who is benefited more by a few pellets of sugar, than by the strongest medicine. Astonishing cures, verging on the miraculous, have been performed, such as the ones at Lourdes, in France, where even cripples who could not walk for years have been made to walk, and semi-paralytics have regained the use of their limbs, due to the almost hypnotic effect of certain healers, who have wielded such a tremendous mental influence over their hearers, that "cures" were almost instantaneous. Not much, however, is said of what happens afterwards to these unfortunates, because there are few such cures that are actually permanent. There are, of course, exceptions. It is like the case of a person who had lost the power of speech, and under stress of great excitement suddenly regained it. Such a cure in many cases has remained permanent. To put it in other words, if there is sufficient mental stimuli, astonishing effects can be had directly on the human body.

It is for this reason that so many quacks and fakers gain a livelihood. In the '90's we had a vogue for patent medicines. Here wonders were caused and actual cures made according to the glowing testimonials of people cured. Subconsciously the patient sees all the good that has been done others and unconsciously, little by little, he becomes a believer and convert, and the medicine often does, in those cases, help; not because there is any intrinsic value in the medicine—because pure water will do the same thing—but because the patient believes that he will be cured. In ninety per cent of the cases, this belief in a cure is the reason for the success of any treatment.

Nowadays, patent medicines are on the decline and other more cunning fakes and swindles are taking their places. SCIENCE AND INVENTION has exposed a number of these, but they are getting more numerous as time goes by. Any shining appliance that looks as though it might do something,—anything with the magic word "electric" pinned to it, and, lately, anything labeled with the word "radio," must be good for all ills, no matter how difficult they may be to cure. Today we have the magic box with knobs, wheels, batteries, dials, meters, and whatnot, to effect cures. Indeed, the mid-Victorian patent medicine vogue threatens to be eclipsed by these fake scientific appliances.

And let no one believe that some of these contraptions do not actually cure. They do, and herein lies the viciousness of such appliances. There is hardly one of these fakes that will not cure some one, simply because that person may have enough faith. Also a very large percentage of these simple minded folk would in time be cured without them—but of course having used the fake appliance, they credit the cure naturally enough to the contrivance. When I made my recent exposé of the famous, or rather infamous, *Ionaco,* hundreds of letters were received by me, and are still being received, denouncing me in no uncertain terms, because the writers had either themselves been cured of certain diseases, or knew friends or relatives who had been cured. This is quite natural, but these good people forget that for every one of these faith cures—because this is all that they are—there are a thousand or more that are total failures. Even the greatest belief in any appliance will not cure Cancer, Syphilis, Tuberculosis, and a great many other diseases. If a patient, who has any one of a dozen harmless things the matter with him, instead of spending anywhere from $50 to $100 for one of these foolish contrivances, would only go to see his doctor, he could save himself not only a great deal of money, but often great disappointment.

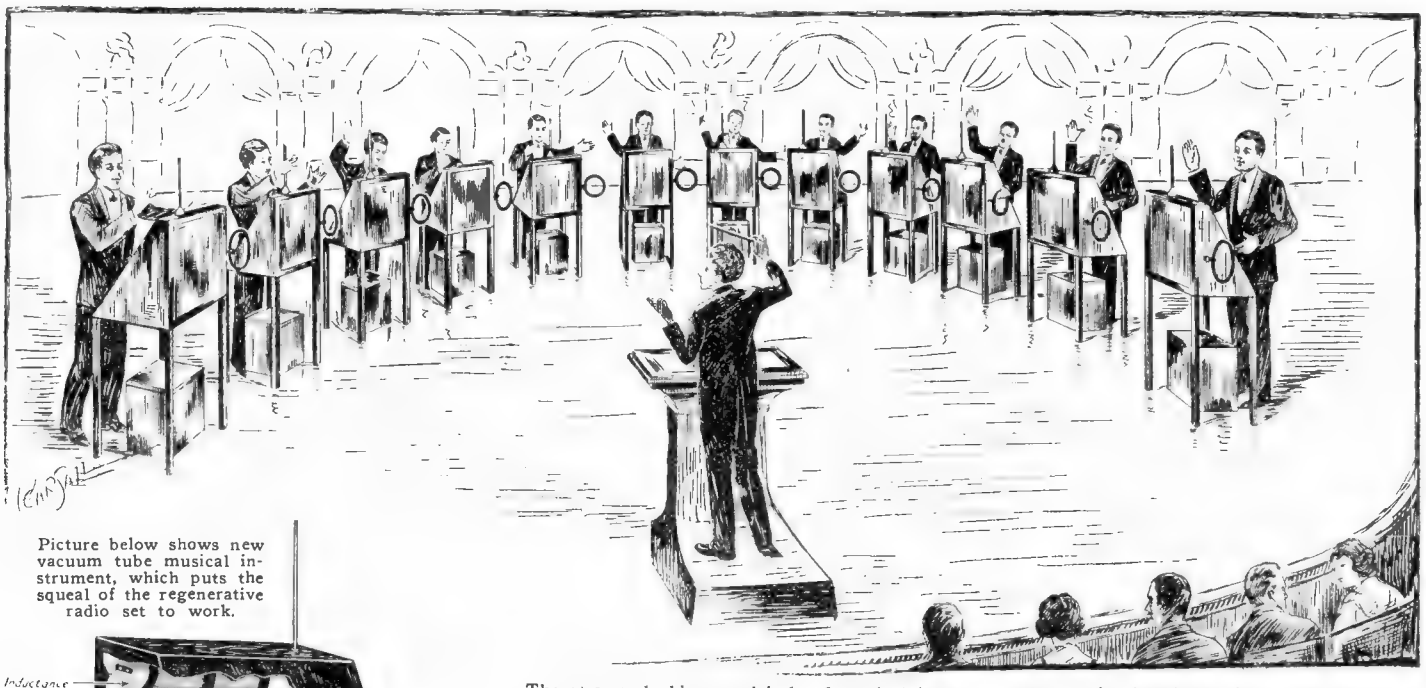
Then too one of the important considerations the believer in these mechanical or electrical absurdities never seems to think of, is the utter dejection and the havoc caused to those unfortunates who buy these appliances and then get no results. Usually their cases are greatly aggravated, because no cures are or can be effected, and so their ultimate despair is ten times as great as it was before. Now a reversal of the faith cure sets in, namely a disbelief that anything could ever cure them. If this idea becomes rooted strongly enough, such cases are hopeless for even the best doctor, because the patient will have lost ALL faith and will have become so skeptical that practically nothing will be of any avail to him. And that is the reason why all fake contraptions of this sort should be ruthlessly exposed, which indeed, I am glad to say, we are constantly doing.

Mr. Hugo Gernsback speaks every Tuesday at 9.30 P. M. from Station WRNY on various scientific and radio subjects.

Hands Create Radio Music

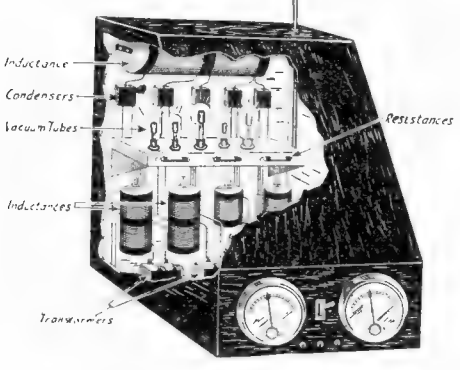
New World of Musical Tones Discovered by Experimenting with the Squeal of Radio Receiving Set

By H. WINFIELD SECOR



The strange looking semicircle of musical instruments we see in the above picture represents the latest scientific discovery by Prof. Theremin, a Russian scientist. Moving the hands toward or away from the brass rod and circle protruding from the cabinet, the consequent changes in body capacity in turn cause variations in the frequency of the currents in the apparatus, and thus produce changes in the tones heard in the loud speakers. In the apparatus shown on the front cover, a horn type loud speaker is indicated, in the apparatus shown above, cone speakers are provided inside the cabinets, with silk screens over them. It is best to use a separate loud speaker on each instrument.

Picture below shows new vacuum tube musical instrument, which puts the squeal of the regenerative radio set to work.



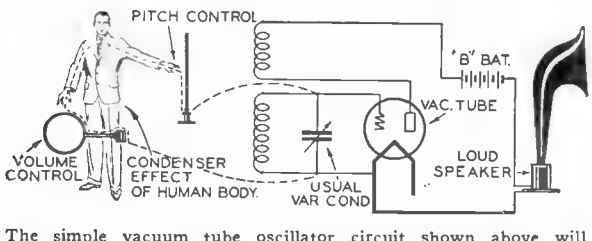
SOMETHING new in the musical world has been accomplished by Prof. Leo Theremin of the Physicotechnical Institute of Leningrad, who recently gave a remarkable demonstration before a large group of musicians, scientists, and music lovers in Berlin. The accompanying pictures show the appearance of the new instrument devised by Prof. Theremin, and he is at present engaged in building twelve of the instruments, so that a full orchestra effect can be demonstrated. Thus far a solo instrument has been demonstrated, and also duet playing on two instruments.

Practically all of the musical instruments with which we are acquainted require careful and tedious training for at least several years on the part of the student. This new instrument which utilizes, as we might say, the squeal heard in regenerative sets when the tickler is improperly manipulated, enables anyone with a musical ear soon to learn to produce a wonderful range of musical notes. Aside from the fact that one does not have to spend years in training or taking musical lessons, Prof. Theremin has accomplished something infinitely greater. With the advent of this new apparatus for producing musical tones, the inventor has made it possible to produce musical notes and tone colors never heard before by the ear of man.

Prof. Theremin's apparatus for utilizing the principle of heterodyning or super-imposing, one electrical current frequency upon another will, the inventor states, free the composer from the despotism of the twelve-note tempered piano scale, to which even violinists must adapt themselves. The composer can now construct a scale of the intervals desired; he can even have intervals of thirteenths, if he desires them. It is in fact now possible to produce any gradation of musical tone or tones detectable by the human ear. Also an entirely new range of tonal colors are available, and instead of the usual average of say, twenty tone colors, represented by that number of different orchestral instruments, Prof. Theremin opens up an almost limitless field comprising thousands of tone colors.

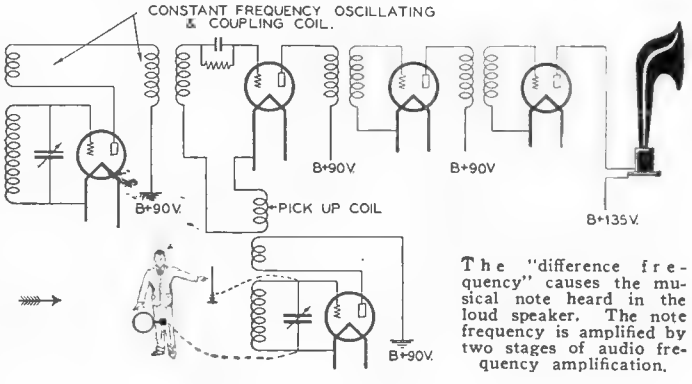
As the pictures on this page show, each instrument comprises suitable arrangement of coils or inductances, condensers, and vacuum tubes. The instrument is similar to a super-heterodyne radio receiving set, as the larger diagram below at once indicates. As explained in the captions, variations in the body capacity are created by moving the hands toward or away from the brass rod or circle, and these variations in capacity in the control oscillator circuit, cause variations in the oscillator current superimposed, through the pick-up coil, on the detector circuit. The constant frequency current is supplied by a master oscillator, as shown at the left of the large diagram. The note heard is that due to the difference between the two frequencies.

(*Continued on page* 754)



The simple vacuum tube oscillator circuit shown above will provide a clear idea as to the general electrical action taking place in Prof Theremin's new musical instrument. With the proper size coils connected in a circuit like that shown, the different notes in the musical scale are obtainable by varying the capacity connected across the main inductance, as indicated.

Changes in the body capacity caused by moving the hands, cause variations in the frequency superimposed by the first oscillator upon the circuit energized by the master oscillator at left. The difference between the two oscillator frequencies produces a third frequency.



The "difference frequency" causes the musical note heard in the loud speaker. The note frequency is amplified by two stages of audio frequency amplification.

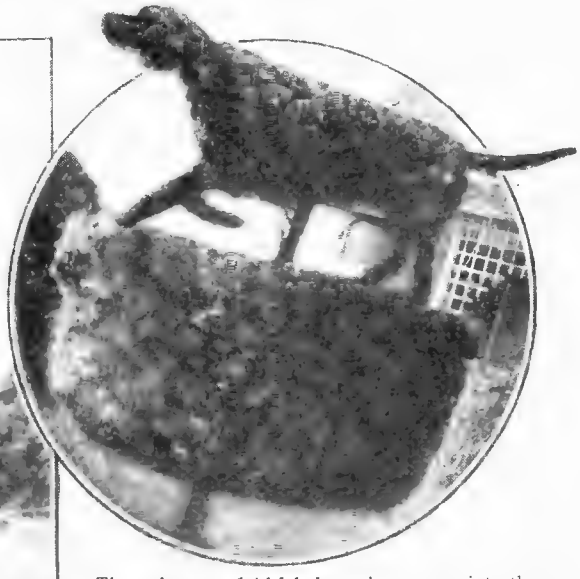
A Tree Menagerie

Cedars Trained in Unusual Shapes

TREES may be trees in most places, but at the home of Mr. and Mrs. Prucha, of Crete, Nebraska, they are a circus. For three years the owners have planned and worked together skillfully and painstakingly, shaping the big cedars in their front yard, until they now have a peacock, a man on horse-back, an elephant, a camel, a dog, an eagle, and a rabbit. Much of the work of shaping the trees was done by tying the lithe boughs. These soon mat and retain a definite shape. The trees are trimmed as little as possible, only the rough edges being cut off, after the desired shape has been worked out. It is only necessary to trim them two or three times each year. This novel zoo has attracted much attention and a parade of interested people are always seen in the front yard. Some of the novel and artistic effects which have been obtained from these trees are shown upon this page and thus some of our readers will undoubtedly be given the germ of an idea.

A man on horse-back, known as Paul Revere, stands guard in the Prucha garden. Infinite care and patience were required before the figure could be shaped realistically. The owners spent three years in training this cedar tree, in the shape shown here. The figure is correct in every detail and even saddle and stirrups have been included.

At the right in the center of the page, is shown a peacock standing over her nest. As may be seen in the photo, the trunk of the cedar tree extends through the center and supports the bird.



The pointer, a faithful dog who ever points the way for his master, is shown above. The like-like appearance is remarkable.

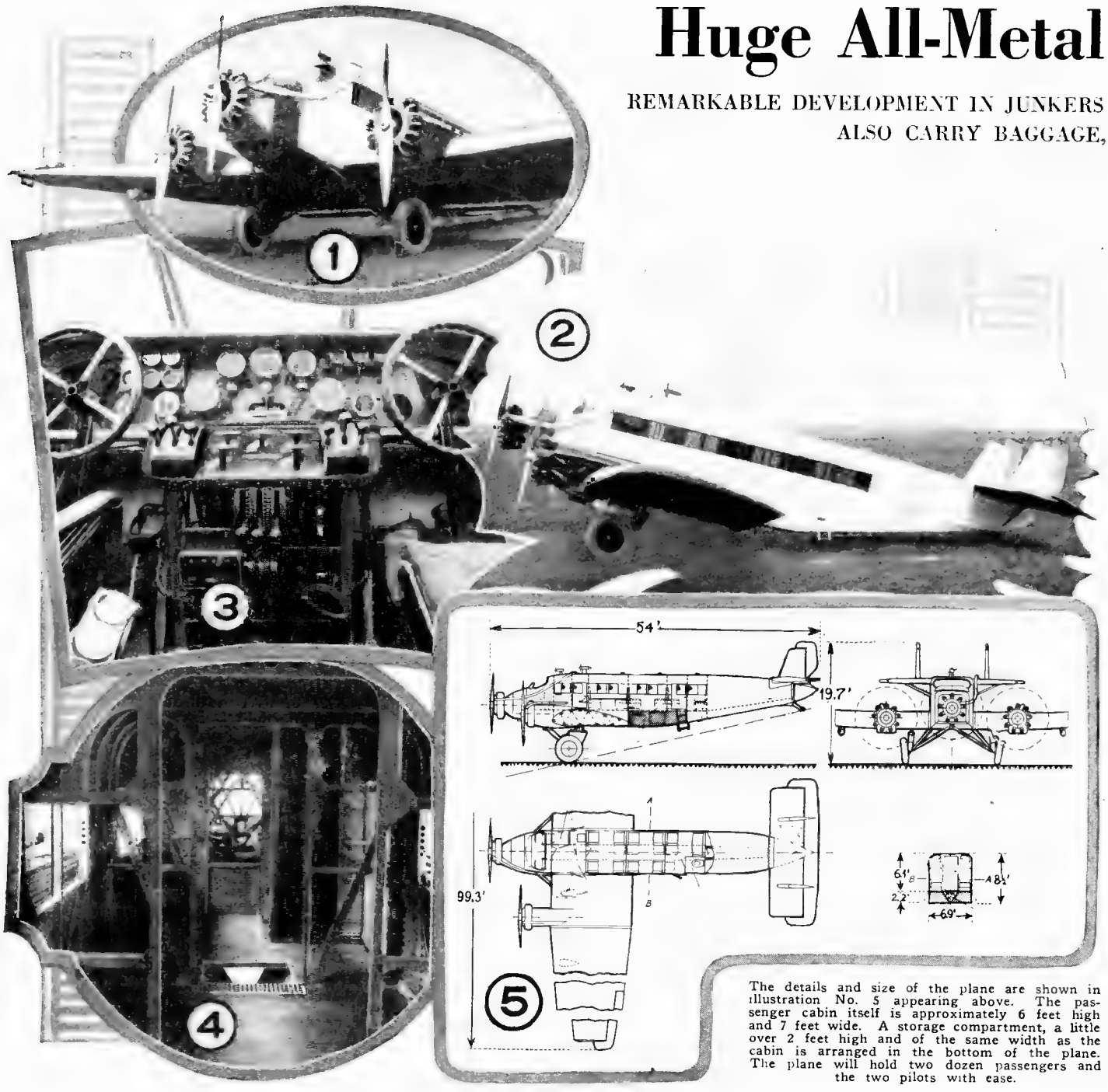
Another inhabitant of the tree menagerie, the camel, is shown above. Some idea of its size may be obtained by comparing it with the tree in the extreme left.

Artistic and unusual are the trained cedar trees shown in the photographs on this page. These figures represent three years' work, but the owners feel well rewarded for the time spent.

A large elephant also graces the Prucha garden. This figure, like the others, is correct in every detail.

Huge All-Metal

REMARKABLE DEVELOPMENT IN JUNKERS ALSO CARRY BAGGAGE,



Photograph No. 1 appearing at the top of the page shows a front view of the new Junkers all-metal monoplane. This tri-motored plane develops tremendous horse-power and has made record flights throughout Germany. Photograph No. 2 shows a side view of this monster airplane. Note the two wind-driven generators mounted on top of cabin, near the forward part of the plane. The shape of the body and placement of wings are clearly shown in this photograph. Note the number of windows which admit light to the cabin.

The details and size of the plane are shown in illustration No. 5 appearing above. The passenger cabin itself is approximately 6 feet high and 7 feet wide. A storage compartment, a little over 2 feet high and of the same width as the cabin is arranged in the bottom of the plane. The plane will hold two dozen passengers and the two pilots with ease.

Photograph No. 3 gives an excellent view of the two pilots' seats and dual control. The plane is so arranged that it may be operated from either the left or right hand seat of the pilot's compartment. Photograph No. 4 gives a view of the interior of the plane when it was under construction. Note that the floor of the plane is also made of metal. The entire plane has been made of an alloy similar to duralumin. Illustration No. 5 shows the details of the plane which is 54 feet long and 19 feet 8 inches high.

SINCE the World War, aviation has progressed by leaps and bounds; its phenomenal growth probably only surpassed by the development of radio-communication. One of the greatest achievements along this line is the Junkers all-metal cabin airliner which is made from an alloy closely resembling duralumin. The plane, which is the first of its kind, will be used in the German passenger service. With a length of 54 feet, a height of 19 feet 8 inches, and a wing spread of 100 feet, this huge plane is one of the largest which has been built.

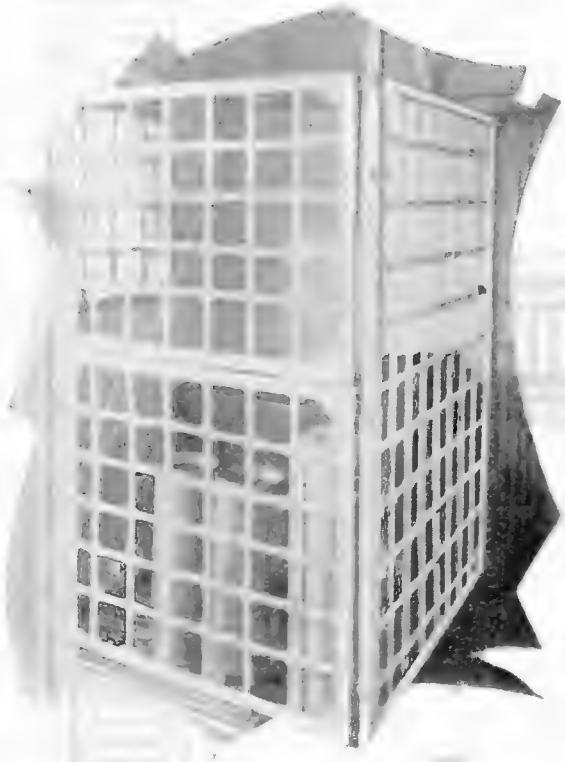
The plane is made of corrugated sheet metal and is completely equipped with all of the latest devices and inventions made in the art of aviation. The passenger cabin has non-breakable windows arranged on either side, comfortable seats provided for the passengers and electric lights. In spite of the fact that it is entirely fire-proof, liquid fire extinguishers have been installed as an added precaution. The plane can be so arranged that hospital patients can be quickly transported from one place to another without any fear of danger or injury which may be produced from excess vibration or bumping. Thus, emergency cases can be rushed to hospitals, from out of the way places and many lives saved. The pilots' dual control compartment, which may be seen in the photograph, is arranged so that the navigator and pilot are afforded a clear view of the route at all times. The plane is equipped with a double set of instruments and controls, so that the craft may be manipulated from either side. Ample space is provided for trunks and luggage which are installed in the side of the body and hot food is carried in special containers of the vacuum wall type.

The methods of joining metallic materials which are available to the aircraft builder are either mechanical or thermal in nature. The thermal means embrace forge welding, gas welding, electric welding, soldering and brazing. All of these involve the partial or complete melting of metal similar to or different from the parts being joined. Gas welding is the most successful of all of the melting processes. The particular means used employs hydrogen and oxygen or acetylene and oxygen to produce the heat necessary to fuse the metal to be joined. This new all-metal plane is held together with rivets and welding has been resorted to only in a comparatively few places.

European Planes

DESIGN OF LARGE ALL-METAL PASSENGER PLANES, WHICH BESIDES SLEEPING AND DINING FACILITIES

At the right is a view of the rear end of the plane. A small door has been arranged so that it may be swung outward and the mechanic can enter. The door is then securely bolted in place. The supporting and the strengthening braces, both in the door and in the interior of the plane are clearly shown. Much of the strength of the plane depends upon the judicious placements of these braces.



Food for the trip is stored in a metal bin which is shown above. The lattice work frame is entirely made of metal and riveted together.

An interior view of the finished passenger cabin is shown at the right. The luggage-rack may be seen above the windows. The upholstered seats may be made into comfortable berths to accomodate over-night passengers. The interior of the cabin is finished in attractive color harmony.

Below we have a view of the cabin showing the berths made up. Note the size of these berths which are a great deal larger than those found on most railroad trains today. Thus the passenger travels in luxury and comfort in record time.

Trunks and suitcases are placed within the body of the plane itself. A door which opens in the side of the plane provides for their insertion. A number of metal tracks, which are clearly shown in the photograph, make it possible for the luggage to be easily shifted. Note that the plane is made of corrugated sheet metal which greatly adds to its strength and durability. During the war the Germans constructed a few planes with metal bodies, but this is the first time that an all-metal plane of such large size has been built in quantities. The plane was designed and constructed at the famous Junkers factory in Germany. The plane has already made several record flights and since 1926 Germany has been provided with the most complete aerial traffic service of any country in the world. The passenger is provided with a specially prepared air map of the route, which enables him to locate places of interest along the way.

Note the size of the individual compartments shown in the photograph above.

Over Niagara Falls

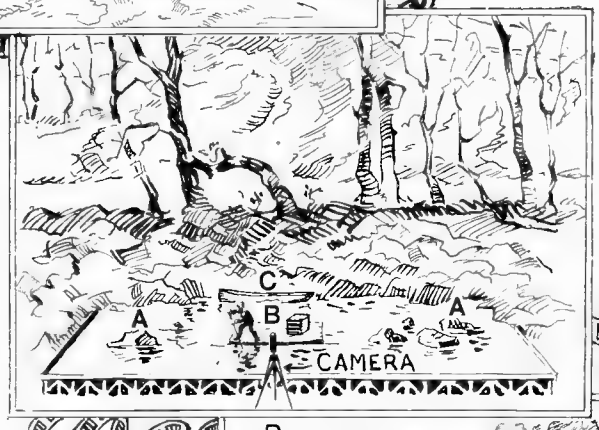
Course of Falls Changed to

By EDWIN

The illustration No. 1, at the left shows the approximate, natural course of the current sweeping close to the small island at the brink of the falls, before the jetties were arranged at points A, B and C of illustration below; jetties are indicated by solid black lines. There are two jetties marked C, one between the channel marked E and the dotted line indicating the path of the current.

In the drawing No. 2, at right, the path of the current is approximately indicated by dotted lines. The jetties were built of sacks of sand and deflected the course of the water toward the island marked G.

Fig. 3 below shows the studio scene where Ed Wynn changes from the boat to the cake of ice. Paraffine ice cakes were used, except the one upon which the actor stood, which was made of cork.

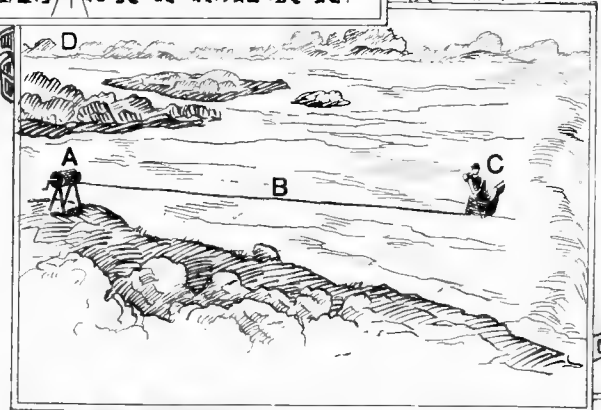


GOING over Niagara Falls in a barrel is a stunt that is often talked about and that has been performed successfully, on at least one occasion, but there has been only one attempt to send a man over the brink of that famous cataract in a chest laden with jewels. This feat is cleverly portrayed by Ed Wynn in the Famous-Lasky-Paramount picture "Rubber Heels."

To accomplish the feat described, the picture makers had to move the falls about twenty feet from their natural position, just off Luna Island, the little island on the edge of the falls next to Goat Island, on the American side. In addition to this, the current of the rushing waters had to be deflected at two other points further back from the brink. Scenes of the actor riding the rapids on a small raft were also photographed at Niagara itself, and were supplemented by several other shots taken at the studio and superimposed on the film. The picture is one of the most remarkable and difficult ever filmed.

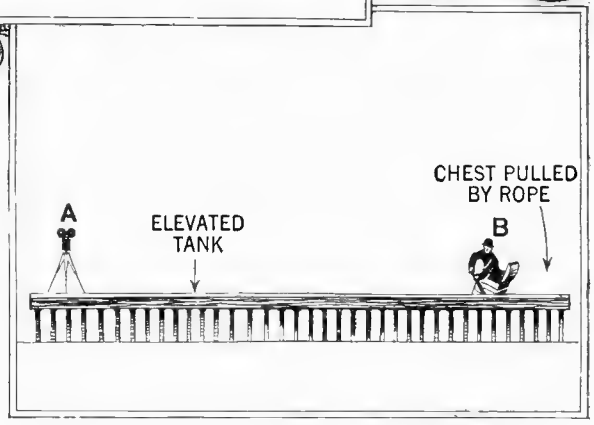
Searching for some crooks, the hero wanders out on the landing where the boat with a chest of jewels is moored. He cuts the boat loose, being afraid of attack, pulls a plug out of the bottom of the boat and hurls the plug at the crook. Water enters the boat and it starts to sink, so he removes himself and the chest to a cake of ice, which in turn starts moving and catches at the brink of the falls. The chest soon starts to go over and Wynn, waving his friends good-bye, shuts the lid. Later shots show the chest going over the brink, as taken from above the falls, and its descent into the foaming waters from below. After bouncing around for a time on the boiling surface at the bottom of the falls, the chest finally comes ashore.

For the scene at the brink of the falls, sand bag jetties were built at three different locations as shown (A, B, and C) illustration No. 2. Approximately 3,500 sand bags were required. The first jetty A was built out about fifty feet from the shore, and drove the current against the island marked G, causing the bulk of the water to be deflected down the channel crossed by the bridge F. The water in this channel rose two feet during this operation. The flow of water toward the falls along the edge of the small island, right at brink, was further broken by a jetty extended from this small island at point marked B. Finally two other jetties were built right at the brink as shown in photo. The surface of the falls was thus made practically dry at this point for a distance of about 20 to 25 feet from the shore. By removing sand bags at end of jetty B shown in illustration No. 1, water flow was regulated down channel E where chest was anchored, while a heavy steel bar was put down in a hole drilled in the rock, and fastened to the raft and chest. This bar was right in the center of same and permitted free movement of chest when Wynn was supposed to paddle. Movement of the chest was accomplished by fastening piano wire to the raft and chest and pulling from the shore. Long shots of chest were done by the double printing method, explained in illustration No. 5. Position of cameras for all these shots was on left side of small island overhanging brink, reached by bridge from Goat Island. Part of these shots of shooting the rapids were taken in studio tank. This set was larger than the diagram indicates, when double printing effect was used. Owing to the position of the camera on the American side, the views of the chest taken from below the falls had to be reversed to match with the shots taken above. The general impression given was that the scenes were photographed on the Canadian rather than on the American side, but this would have been impossible, owing to the mist which rises from the Horseshoe Falls. Wintry conditions aided the picture men in their enterprise of controlling the waters of the falls to some extent, but made all work exceedingly difficult because of the cold. The flow of water on the falls is of course retarded to a greater or less extent by freezing. All the scenes shown here were taken during later winter and spring thaw. The various illustrations and photographs appearing on the two pages show clearly the various jetties which had to be built and also the trick studio scenes



In Fig. 4, at left we see how the movement of the raft was regulated by a windlass at point A. Heavy steel cable, indicated by B was attached to the raft C. Three Sisters Islands helped to break the force of the flow.

Fig. 5 below shows a studio shot. The chest was tilted in the studio tank and this image was superimposed on long shot of falls.



In the above A is the camera and B is the chest pulled by a rope.

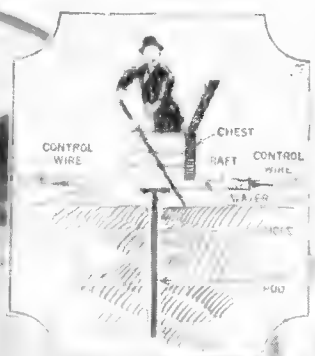
For Movie Comedy

Make Comedian's Stunt Possible

SCHALLERT

A photo taken in the process of filming Ed Wynn's superb comedy "Rubber Heels" is shown above. Note that cameramen and directors are standing knee deep in icy water.

The photograph above shows a scene on the edge of the falls next to Luna Island, on the American side. Note the sand bags used for the jetties which were shown in the second illustration on the opposite page.



At the left we have an illustration showing how the chest was guided at the brink of the falls.

The photo at the right shows the effect which was produced when the water was allowed to flow through channel E, by removing the sand bags at the end of jetty B. By referring to the second illustration appearing on the opposite page, one can readily see how this was accomplished.

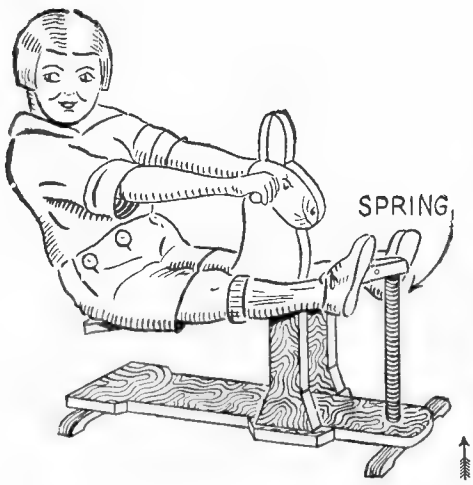
A large number of men were required to hold the steel cable attached to the chest for the scene which actually shows it going over the falls. The force of the water was so terrific as the chest was allowed to approach the brink, that the men were finally forced to let go and eventually the cable was cut close to the anchor when the scene was photographed from below.

The above photo shows the set-up when the chest was recovered from the water after it had gone over the falls and the actor was supposed to be inside. He did not actually go over the falls in the chest

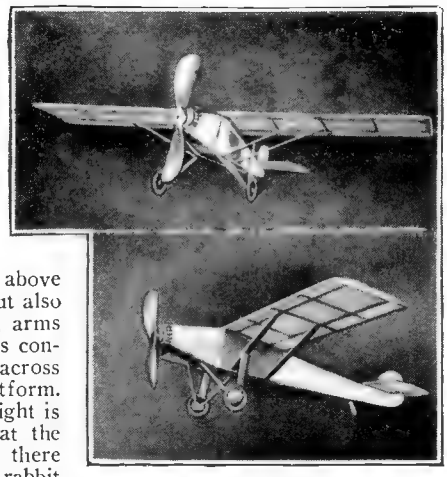
The above photo shows the large number of men that were holding the land end of the cable which was also anchored. The chest went over the falls in the channel, crossed by bridge F

SCIENTIFIC ADVANCES

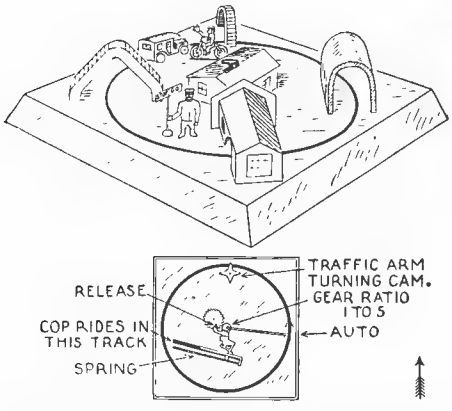
Inventors Are Constantly Busy Devising and Designing New So Great That It Even Permeated Into the Model And mobile Has Been Reduced



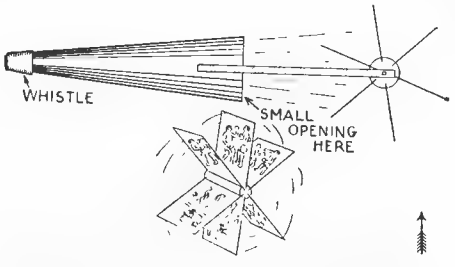
FOR the kiddy who has no companion, the above see-saw is not only a source of amusement but also a means for exercising the muscles of the legs, arms and back. It will be observed that the apparatus consists of a wooden base fitted with two uprights, across which the bolt is fastened for the swinging platform. The child sits upon the seat provided and his weight is well counterbalanced by a coiled steel spring at the further end. This novelty is well balanced and there is no danger at any time of it upsetting. A rabbit or other animal arising from the center of the board holds the grips. The spring connects with the base-board, to which it is secured by a bolt, and the foot-rest on the swing.—*Courtesy Teter-Rabbit Co.*



Here are two photographs of a model airplane in actual flight. This article represents a scale model of the famous Spirit of St. Louis airplane, piloted by Col. Charles A. Lindbergh in his epoch-making flight from Long Island to Paris, France. See below.

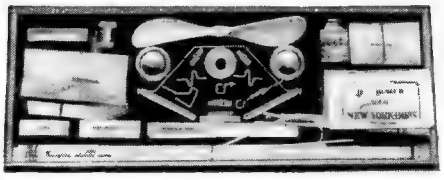


HERE is a unique spring-wound novelty inspired by motorcycle officers and speeders. A small automobile runs around a circular track, and after having made five revolutions, it passes a stop signal, whereupon a traffic officer on a motorcycle hiding behind a building, dashes out and stops the speeding auto. The diagram below indicates how the device operates. When the traffic officer is withdrawn in back of the house, the trigger is released, permitting the auto to make five revolutions again before being stopped.—*Courtesy Louis Marx & Co.*

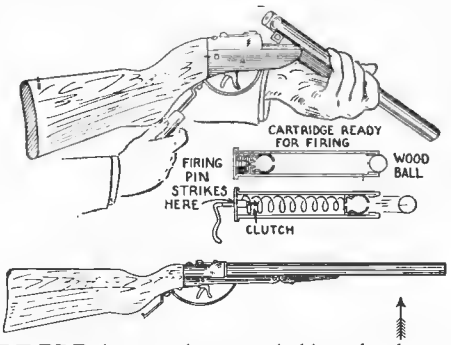


WITH the whistle illustrated above, there are a pair of arms holding a wooden roller. The roller is slotted with six slots, into which a series of cards are placed. When the whistle is blown, the fan turns, producing a motion picture of either a prize fight or a dancer. Disturbing the sequence changes the action.

—*Courtesy Educator Playthings Co.*

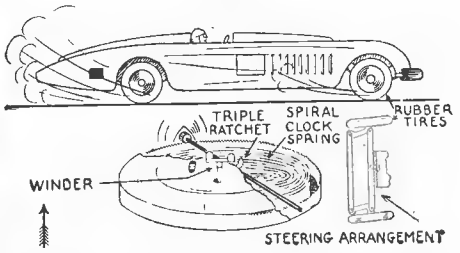


HERE is the way in which the parts for the construction of the Lindy Airplane come to the purchaser. The complete kit contains everything from glue to rubber for the propeller. Any novice can assemble the airplane by following the directions and, of course, the more time and care, the better will be the resulting model in respect to its finish. This article should appeal to both boys and men, if for no other reason than that it is a replica of a world-famous airplane. But, there is another reason, and that is, that the plane actually flies. A third, that the boy learns not only how to fashion things of wood, glue and nails, but may even use his inventive ability on designs of new types of airplanes and may even master the first principles of flight from the way the model operates.—*Courtesy Ideal Airplane and Supply Co.*



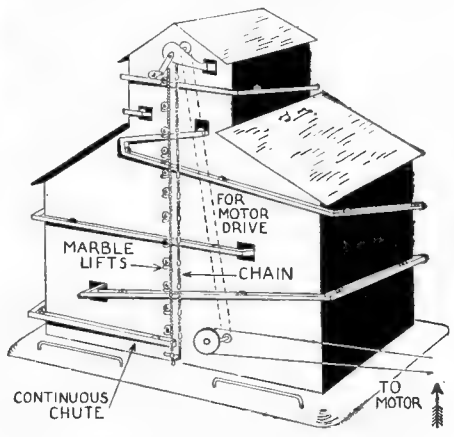
HERE is a truly remarkable take-down double-barrel shot gun which is loaded with metal shells and fired just like Dad's. The only difference is that this mechanism is operated by a spring, the shells themselves containing the spring and the bullets are harmless wooden balls. The top illustration shows the gun broken and one of the cartridges being loaded.

—*Courtesy A. H. Fox Gun Co.*



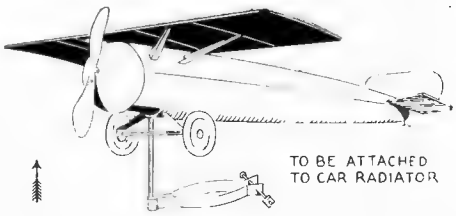
HERE is a toy modelled after the famous Mystery S which was driven by Major Segrave at a rate of more than 207 miles an hour on the sands of the beach at Daytona, Fla. The novelty is a replica of the original in every respect, except that it carries a rubber bumper in front to prevent marring of furniture. A powerful flat spiral spring is geared to the rear wheels and the front wheels have the same steering arrangement which one finds on any automobile. All wheels are rubber tired, the rubber being vulcanized directly to metal discs. The novelty is decorated with a heavy coat of enamel and suitably painted with the American and British National emblems.

—*Courtesy Kingsbury Mfg. Co.*



ONE of the most colorful novelties on display this year is the marble elevator shown in the diagram above. This toy approximately 22 inches high, comes unassembled but unique directions, including a cut-out, demonstrate how the device is to be set together. It consists of an endless chain elevator which lifts marbles to the top of the chute from which they travel around the building and through it with the attendant clatter and the colorful effect of the myriads of balls. The device can be driven by motor if desired, arrangements being made for this purpose, or it may be employed as a test of skill to see who can raise the greatest number of marbles to the top before the first one reaches the bottom.

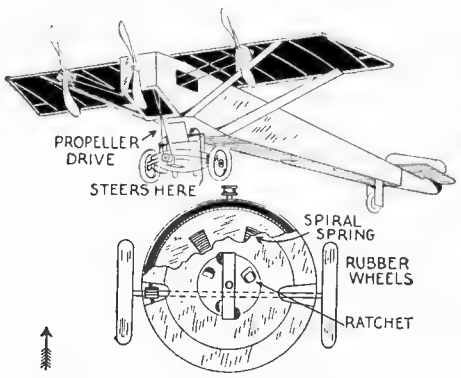
—*Courtesy Toy Creation Shops.*



HERE is a silvered metal airplane made similar to the Spirit of St. Louis, which can be attached to a car radiator. The propeller is mounted so that it rotates freely.—*Courtesy Kingsbury Mfg. Co.*

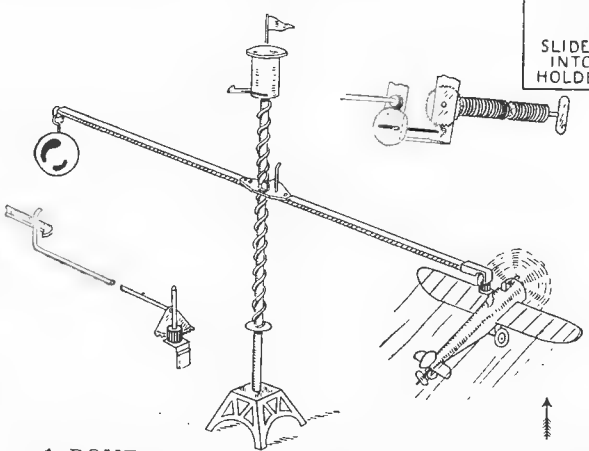
IN 1927 TOYLAND

Toys. The Trans-Atlantic Flights Have Left an Impression Toy Field. Even Major Segrave's Record-breaking Auto- to a Spring-wound Replica

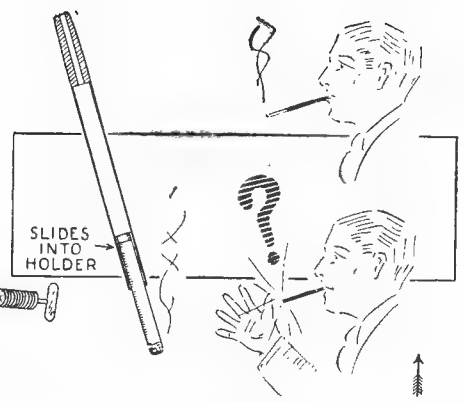


HERE is a metal three-motored plane provided with rubber-tired wheels and with a powerful spiral spring motor geared to the wheels and also geared to a pulley which communicates with the three motors as the diagram shows. The plane will proceed straight ahead or turn in a small circle. It has a scintillating metallic finish.

—*Courtesy Kingsbury Mfg. Co.*



ABOVE—a German novelty comprising an upright, and a cross-beam to one end of which a spring-wound airplane with collapsible wings is fitted. The airplane is counterbalanced by a weighted ball. When wound up the plane proceeds to the top under its own power, where a trip in the tower reverses the direction of the plane and it comes down by gravity. Upper right-hand detail shows why no ratchet is employed on the spring, the gear slipping past the propeller shaft when the spring is wound.



MAGIC also has many new additions to add to the Christmas list of this year. We show here only one of the new novelties. This is in the form of a cigarette holder. The performer is smoking a cigarette. Passing his hand around the lighted cigarette, he apparently tosses the smoke into the air and presto, the cigarette has disappeared. The secret lies in the fact that there is a small metallic ring which holds the cigarette within the holder. By drawing the breath through the holder rather sharply, the cigarette slides in it. Under ordinary circumstances there is nothing to interfere with a quiet smoke.—*Modern Magic Co., Inc.*

Echoes of the Ionaco Exposé

IONACO STILL ADVERTISING

Editor, SCIENCE AND INVENTION:

In your October number of SCIENCE AND INVENTION I was much interested in your showing up "The Ionaco Swindle."

In the Sunday September 18th edition of The Art Gravure Section of The Cleveland Plain Dealer, I noticed an advertisement of the Ionaco with office at the Hanna Building, Cleveland, in which you might be interested.

LORN CAMPBELL,
Cleveland, Ohio

(There are a great many newspapers in the United States that are carrying Ionaco advertising. Some of these organizations do not know that the Better Business Bureau has made an investigation of the Ionaco; others would not care about this information as long as the advertisements bring in a financial return. It is to be regretted that our press is unscrupulous enough to take advertisements from organizations selling products of questionable repute. Fortunately, the Cleveland Plain Dealer is not in this latter category. The Ionaco organization of Cleveland were forwarded copies of our magazine containing the article on the subject.—EDITOR.)

RUPTURE CURE

Editor, SCIENCE AND INVENTION:

I will appreciate it a great deal if you will kindly let me know whether this article will do what they claim it will or not?

I have written to them, and they inform me that it will cost from $9.00 to $15.00.

I thank you in advance for any information that you may extend to me.

EDWARD JAMES COLEMAN,
East Boston, Mass.

(Mr. Coleman sent in a column advertisement of a button rupture cure which it is claimed seals the rupture instead of pressing it and allows the users to run, jump, bend and cough in safety.

Most of these truss-less rupture cures consist merely of a piece of court plaster, provided at the center with a pad containing a small quantity of salve of no particular value or else an air cushion serving the same purpose as the air cushion truss. While it is true that they are of some advantage in the treatment of small protrusions, there are many cases in which their use is contra-indicated. We think that the price is exorbitant for the rupture button, but someone must pay for the advertising.—EDITOR.)

PROSTATE GLAND TREATMENT

Editor, SCIENCE AND INVENTION:

I am a seller and reader of SCIENCE AND INVENTION and have just read your exposé of the Ionaco (Horse Collar). I would like you to give me your views as to the value of a machine for curing Prostate Gland trouble. It is manufactured and sold by the Electro Thermal Co., Steubenville, Ohio.

Hoping that you will be so kind as to favor me with this information and thanking you in advance for same, I am

J. P. CLARK,
Los Angeles, Calif.

(The Electro Thermal apparatus consists of a heated electrode. Many prostatic troubles are treated by heat and the electrode enables heat to be applied as near to the gland as it is possible from an external source. While every prostatic condition would not be cured by such a system, there are many that will lend themselves to treatment. In our opinion, this apparatus cannot be classed among the many mechanisms which are fraudulent. Doctors of medicine make use of the apparatus in similar treatments.—EDITOR.)

IN the October issue appeared the full details concerning Ionaco, the magic coil of wire which cured all ills. Since that time, the editors have been deluged with letters of all sorts of quack systems and circulars of numerous imitations of Ionaco. It is strange to relate that Mr. Gaylord Wilshire, the inventor of this "life-belt," as he called it, and horse collar, as medical men call it, should have died of the very ailments for which Ionaco was supposed to be a specific. Some of the letters and their answers appear on this page.

FROM THE WICHITA, KANSAS IONACO OFFICE

Editor, SCIENCE AND INVENTION:

I have just read your ridiculous article about "Wilshire's Ionaco," the most marvelous thing that has ever been found for the human race. Now Bright Eyes—I would like to tell you a few things I know about this wonderful "Ionaco." You make fun of the many ills we claim to cure. We have 200 satisfied owners of "Wilshire's Ionaco" here in this city; better come out and give a lecture and see how far you get.

"I don't know how much the doctors paid you for putting this article in your cheap magazine, but I do know you can make some real money on a bet.

I can produce three patients who have been cured of eczema, two patients cured of bakers flower poison of fifteen years standing, arthritis of one year standing. Many cases of Rheumatism, all kinds of Hay Fever and Asthma.

Now you are so smart—we have two patients that had perfectly white hair and the "Ionaco" has turned it black at the roots (the natural color). Now I suppose you will call me a liar, but money talks.

We cured a case of Lumbago in one treatment and reduced high blood pressure from 205 to 152 in eleven treatments. Now laugh that off. We have cured a case of Varicose Veins of eighteen years standing with a Varicose ulcer in four months, two cases of acne, one fourteen years standing in three months. Ulcerated stomach in twenty-nine treatments. You don't believe all this, of course you don't. You are too smart.

Have you ever taken three to six months treatment with "Wilshire's Ionaco" or had any friend taken treatments? No, you are just shooting off in your article what you think or what you have heard from some bright mind.

You also say "Wilshire's Ionaco" can be made for $3.50 in the east—how ridiculous. I will just buy a little bunch at that price, for I can get $58.50 for every one of the real "Ionaco" with the Wilshire make and brand which you would have to have on each machine.

We do not claim to cure every patient we treat, and we do not want to sell them an "Ionaco," unless they can be benefitted. We do claim that we have had cures in every disease mentioned in our pamphlet.

Now read this—we sell the "Ionaco" on a money back guarantee, 90 days; if it does not benefit the patient, we take it back. How many doctors refund a cent if they do not cure you? (None.)

Better get acquainted or informed about this Wonderful "Wilshire's Ionaco," the wonder of the age, even if it is a little bundle of wire.

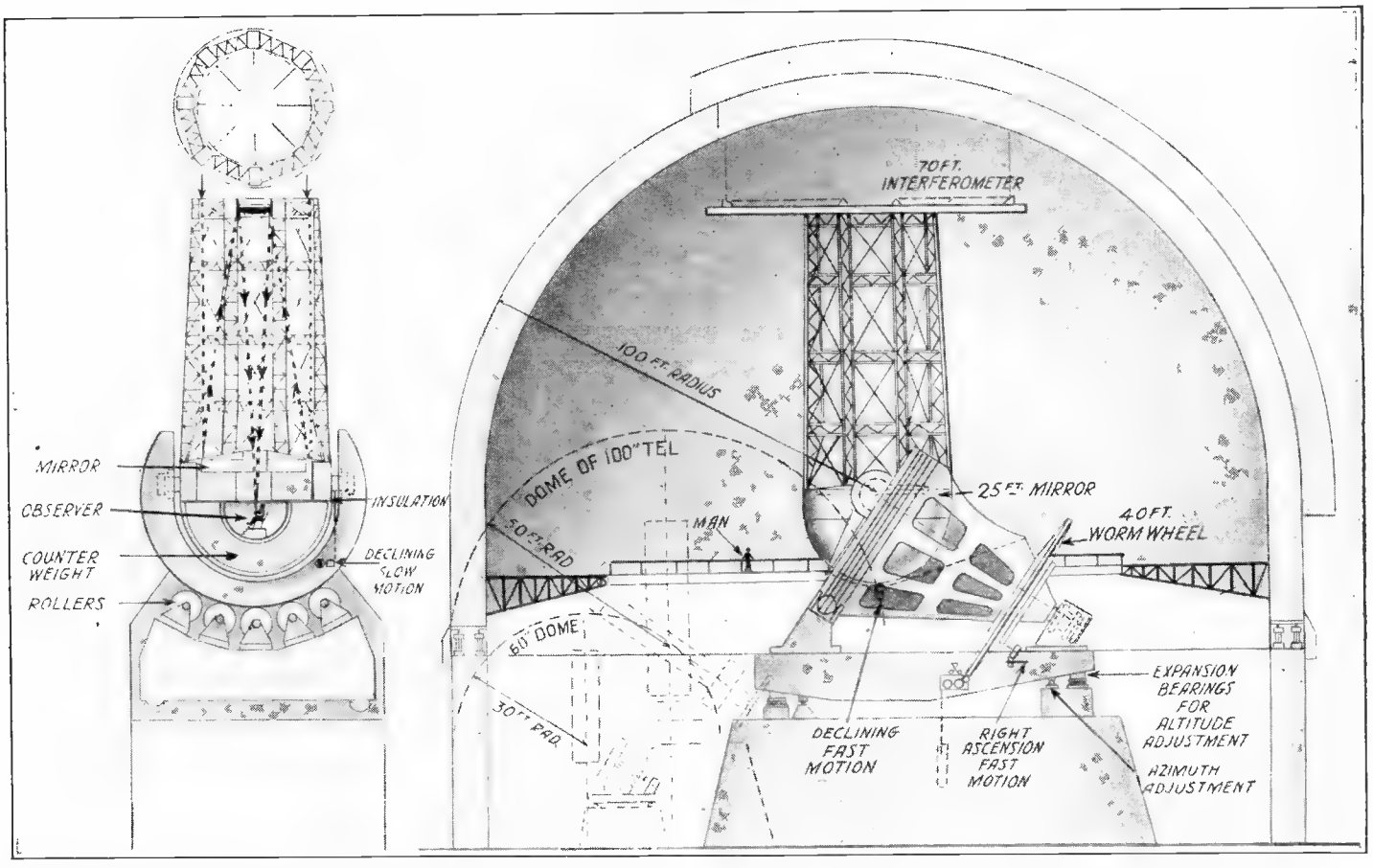
I have your cheap magazine opened to the page 490 and have it where my patients can read it, see? The results they are getting and the marvelous things the "Ionaco" is doing and has done cannot be overcome by your half baked article. We will still sell them at $58.50 cash; $65.00 on

(*Continued on page 757*)

HUGE TELESCOPE TO PROBE SKY

By W. J. LUYTEN

World's Greatest Telescope and What Benefit We Would Derive from It, Is Discussed by Harvard Astronomer



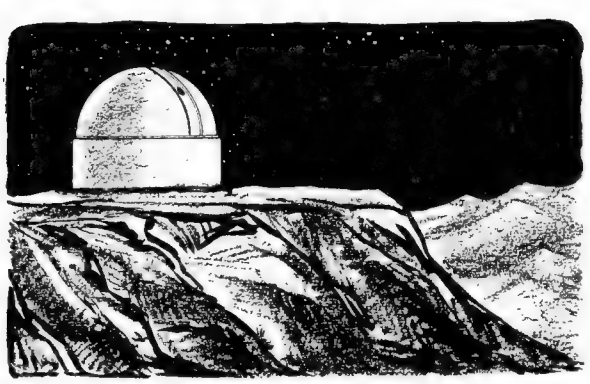
The illustration above shows a sectional view of the new Pease 300 inch diameter telescope, with which it will be possible to learn many new things about our neighbors in space. The light-gathering power of this huge telescope is nine times that obtained with the present one hundred inch telescope. The cost is still higher, as it is over twenty-five times that of our present largest reflector.

TO solve the riddle of the canals on Mars, and of the mountains on the Moon, to triple the number of stars which are observable from the earth, to discover nebulae, and "island universes," at distances from 100 to 10,000 million light-years, and last, but not least to extend our knowledge of creation three times beyond what can be reached at present, these are the goals which astronomy has set itself to attain in the near future, and to accomplish such a stupendous task, plans are being made for a giant reflector with a mirror 25 feet in diameter, far surpassing anything in existence. Barely seven years have elapsed since the successful completion of the great 100-inch reflector at Mt. Wilson, seven years full of the most startling discoveries, years in which our knowledge of the universe has increased by leaps and bounds, and already astronomers are wishing for another, and bigger, and more powerful instrument.

Dr. Pease, the designer of the 100-inch telescope, after carefully looking into the subject from all angles, has come to the conclusion that a telescope with a mirror of 300 inches would be the most satisfactory for the present, and would at the same time represent the limit to which man can go for a long time to come.

COST $12,000,000

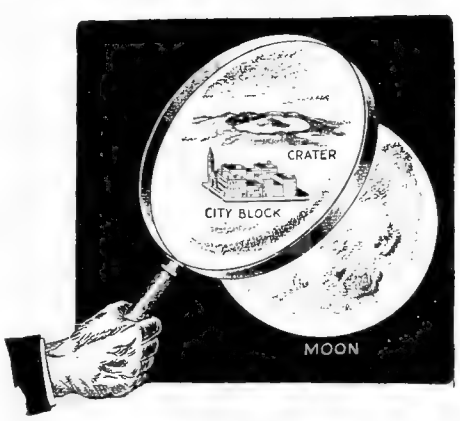
The cost alone, a trifle of $12,000,000 being estimated for this giant of the future, would discourage any further planning, for we know that the cost of telescopes increases disproportionately with augmentation in size, almost as the cube of the size. A 100-inch telescope, therefore, costs about five times as much as a 60-inch, and a 300-inch will cost 25 times as much again. The light gathering power goes up as the square of the size, of course, since it is proportional to the area of the mirror but the space-penetrating power increases merely as the first power of the diameter. Therefore, a 300-inch telescope represents at present the most efficient advance in telescopes.



The best location for the three hundred inch telescope is on a high dry plateau, where the weather is clear the year round.

1,600 TONS BALANCED LIKE A WATCH

But, the huge cost of it is not all. There is a great deal more to it. The optical and engineering difficulties that are to be overcome are of a sort that have never been encountered before. Take the bulk of the thing for instance. The plans drawn by Dr. Pease call for a telescope weighing 1,600 tons with a length of well over eighty feet. And yet such a monster must be capable of following minutely the motions of the stars in the sky, and must respond to the slightest desire of



Picture at right shows how three hundred inch telescope would enable us to see things on the moon as small as a city block.

the brain directing it. There is a problem in balancing for you! The whole instrument will be housed in a dome of over 200 feet in diameter.

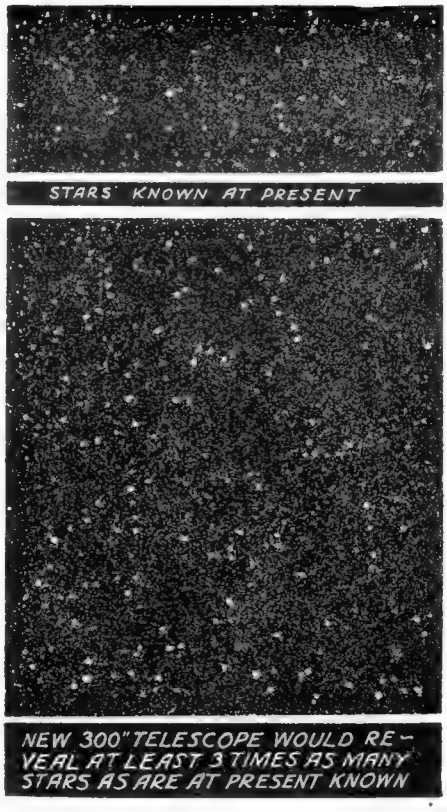
But let us begin at the beginning and take up the various parts in detail. Take the mirror itself first, the heart of the telescope. The first reflecting telescope ever made was constructed by Sir Isaac Newton; it contained a small metallic mirror made of speculum metal. Later, as the technique of mirror making advanced metallic mirrors gave way to glass ones, coated with silver, since these silver-on-glass mirrors have a much higher reflecting power than the copper-tin speculum mirrors. But now that we are dealing with mirrors of sixty and a hundred inches in diameter, other problems are coming in, which were never dreamt of in Newton's time. With the hundred-inch mirror at Mt. Wilson, it is of extreme importance that the mirror shall have one temperature throughout. A change of as much as one degree from the inside toward the edge of the mirror will distort the parabolic figure enough to throw the star images not only out of focus, but to elongate and blur them and change them from small pinpoints, which are from the astronomer's point of view ideal, to great beetle shaped dots, entirely useless for precision work. And you can imagine how much worse a 300-inch will be; not to mention the difficulties to be overcome in casting and annealing the huge disk of glass. If the disk were made of ordinary glass it would take months and possibly years of gradual cooling before the disk would be ready for grinding and polishing. What we need in astronomy is an ideal substance, "mirrorite" Mr. Pease calls it, which shall have as high a reflecting power as silver, be much less brittle than glass and have practically no coefficient of expansion.

QUARTZ FOR LARGE MIRRORS

Fused quartz will very nearly do. The chief draw-back with quartz, however, is that it cannot yet be fused in quantities large enough for such a gigantic mirror. Experiments which are being made at the General Electric Company laboratories indicate, however, that perhaps ultimate success may be attained by using a foundation of crude and opaque quartz, coated with a thin but durable layer of high grade transparent quartz which may be ground and polished until it has the required parabolic figure and then silvered. The beauty of quartz is that it can be ground as fast as one wishes, there never need be any fear that it will crack as a result of the heat generated locally by the friction of the grinding tools on the mirror, as would be the case with glass.

Having disposed of the mirror we must next turn to the construction of the telescope itself. On account of its enormous size, and light-gathering power, the instrument will be used in many different forms, and in order not to lose valuable observing time at night, it must be made possible to

A graphical idea of the relative sizes of the present 100 inch telescope mirror, and the new 300 inch diameter mirror. The light-gathering power of the 300 inch mirror is nine times that of the 100 inch diameter mirror.



Some idea of the tremendous light-gathering power of the new 300 inch telescope may be gained from the illustration above; it would reveal to the astronomer at least three times as many stars as are at present known.

change over from one form to another very quickly. For instance, after one has observed with the spectroscope for awhile and wishes to take a straight photograph, or put on a photo-electric cell or a thermo-couple to measure the heat of the stars, such a change should be made with the utmost rapidity.

OBSERVER TO BE INSIDE TELESCOPE

The novel design which Mr. Pease has presented will do this and more. Quite a departure from custom is his idea of putting the observer inside the telescope, and making him move with the instrument as it follows the stars in their courses. A strange thing to get used to for people who have only made the acquaintance of small telescopes, where a slight touch of the hand is enough to throw the instrument out of adjustment. Here, in Mr. Pease's new telescope, the observer stands, and walks inside the giant instrument, and yet it registers not the slightest disturbance. It hardly would if one considers that the moving parts weigh over 1,000 tons; the addition of a few hundred pounds of human flesh could not be felt. And yet, as the astronomer stands inside, watching through the eyepiece to see if the telescope is following the stars closely enough, he need merely press a button with his little finger, and the whole gigantic mass of 1,600 tons will swing noiselessly back and forth, following minutely the wishes of the directing brain inside it. And here, in his cage, the astronomer would have but to press another button, and a huge spectroscope, weighing several tons, would roll automatically into position. And all the time a great driving clock, deep down under the solid foundation of the telescope would furnish the motive power, and, acting upon a huge worm-wheel, would carry the telescope around to counteract the earth's rotation.

WHERE TO LOCATE TELESCOPE

After the telescope has then been finished, all that remains is to find a good location for it. Experts have long disagreed about the disturbing effect of the atmosphere on such an enormous instrument, but tests made at Mt. Wilson indicate pretty conclusively that this disturbance will not be any worse for a 300-inch telescope, than it is for a 60-inch. Nevertheless, it will be highly advisable to find a suitable climate, preferably somewhere on a high dry plateau, where the weather is clear the year round. In such a location the turbulence of the atmosphere would be a minimum, and there would be little danger that the star images would appear blurred and lose all distinction through the action of air currents in the telescope.

These are the scientific requirements; the human element introduces two more conditions, firstly the new observatory must be located not too far from civilization, in not too lonely a spot, easily accessible by train or by auto. For nothing is so important than that the actual observers maintain their contact with their fellow beings, and preferably with fellow scientists, in order that they may not lose their scientific perspective, and become hermits in an observatory, upon their way to insanity. And secondly, the observatory must be located in a country which is free from volcanic disturbances, be these of geological or of a political nature! For, with an expenditure of 12 million dollars one may reasonably expect the new telescope to last at least two centuries.

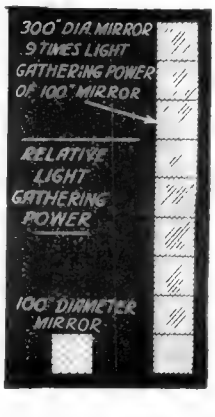
Now that we have enumerated all the difficulties of construction and all, apparently over-meticulous demands which the astronomers are making, people may ask: is it worth spending $12,000,000 on? Twelve million dollars for one piece of apparatus, for one more astronomical toy! But we must not forget that it will constitute a gilt-edge scientific security of the very best kind, something permanent and capable of yielding great and continuous profits. And after all, at the present stage of civilization, 12 million dollars is not an impossibility. If all the nations of the world would construct one less battleship apiece, we could easily get half a dozen twelve million dollar telescopes. Still one may ask, is it worth it? But then, is there anything that has contributed so much to broaden Man's outlook on the Universe as the telescope? The stars we can see with the unaided eye are not the universe. The astronomical universe of to-day is telescopic, wholly telescopic, and nothing is so imperative to a civilized being as to understand the universe in which he lives.

OUR PRESENT TELESCOPES

And our present artillery with which to attack the ever retreating secrets of the universe, comprises only one 100-inch (Mt. Wilson), one 72-inch (Victoria, B. C.), one 60-inch (Mt. Wilson) and all of them on the northern hemisphere. The new 60-inch telescope which Harvard is planning to erect

(*Continued on page 737*)

The chart at the right shows clearly the great increase in light-gathering power of the 300 inch mirror compared to the present largest 100 inch mirror.



The picture at the left shows sectional view of the present 100 inch telescope mirror and the new 300 inch mirror. The 300 inch mirror may be made of a new material.

Ore Located by Seismograph

Dynamite Produces Artificial Earthquakes for Recorders

MAN's quest in search of systems for the location of ore has at last taken him into the seismographic field in which he produces miniature earthquakes by means of explosions by dynamite, three or five miles away from the seismographic recorder and then, by means of interpreting the seismographic records, he is able to determine both the nature of the underlying earth strata and the composition of the same.

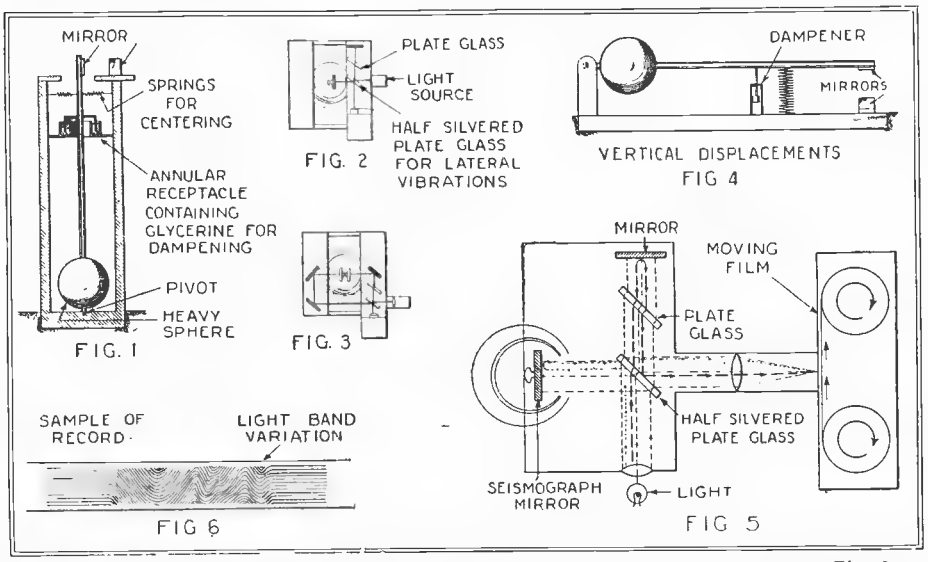


Fig. 1 above shows a view of the seismograph for recording horizontal displacements. Fig. 2 indicates one form of recording device, and Fig. 3 shows a second style. Fig. 4 is a seismograph for vertical displacements, and Fig. 5 indicates the direction of the light beam, its division, and the production of the interference bands on the moving film. Fig. 6 is a sample record.

In the method invented by Norman H. Ricker of Houston, Texas, for which a patent No. 1,625,-625 was recently obtained, we find this method explained in great detail. By examining the diagrams accompanying this article, the reader will note that there are two seismographs, both equipped with interferometer systems and a moving film. One of these seismographs produces a record of vertical displacements of light bands and the other, records lateral displacements. By reason of the exceeding sensitiveness of the observing and measuring devices, provided by this invention, it is possible to explore geological formations through the artificial earthquake propagation method.

Briefly, the system comprises the causing of artificial earthquakes by means of explosions of dynamite. These explosions may be produced five or even ten miles away from the recording instruments. Now, since the disturbances in the crust of the earth are modified by geological formations, it is possible to secure a number of readings from which the character of these formations can be interpreted. These records are permanently inscribed on photographic film so that the individual using the instrument need not be the actual interpreter of the record, but he can send the records to an expert who will be able to diagnose the character of the earth and tell whether there are any ore veins present, of such nature, character or size as to make it worth while proceeding with further exploration and development. The device may be likened to the systems used during the World War in which seismographs were used to locate the enemies' hidden or camouflaged artillery.

In actual experiment, one organization permitted their engineers to map out a section where the company did not know a salt dome existed. The engineers returned with the report that oil would be discovered at a depth of approximately 2,500 feet. The company drilling in order to substantiate the engineers' claims, struck the oil at 2,400 feet and struck the dome within a hundred feet of where the engineers predicted.

The recording is generally done from the three corners of an equilateral triangle, the dynamiting taking place at the center. If a salt dome lies somewhere within the area covered by the recorders, a refracted wave is produced and recorded.

It has been found that about 98 percent of all oil in the coastal section lies in salt or sulphur domes.

If We Had No Ears!

Does a Tree Falling In An Uninhabited Forest Make a Noise?

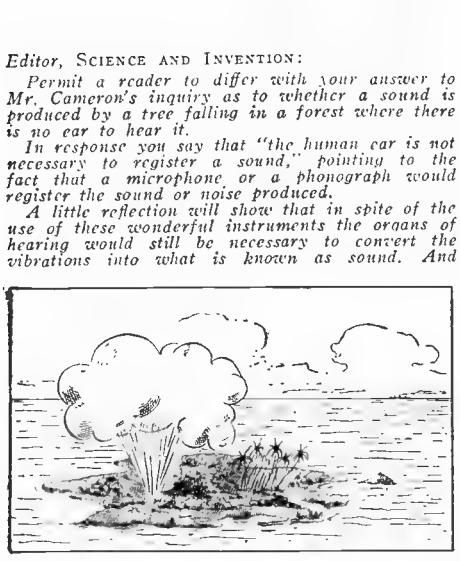
By JOSEPH H. KRAUS

Editor, SCIENCE AND INVENTION:

Permit a reader to differ with your answer to Mr. Cameron's inquiry as to whether a sound is produced by a tree falling in a forest where there is no ear to hear it.

In response you say that "the human ear is not necessary to register a sound," pointing to the fact that a microphone or a phonograph would register the sound or noise produced.

A little reflection will show that in spite of the use of these wonderful instruments the organs of hearing would still be necessary to convert the vibrations into what is known as sound. And sound is subjective and not objective and is essentially undefinable. The best that the dictionary and encyclopaedia makers can say is to define sound as the sensation produced by the organs of hearing. In other words, sound exists nowhere else save in the body of some living organism equipped with an ear or ears.



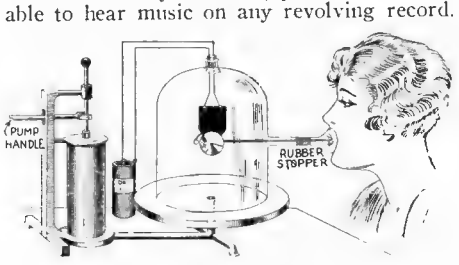
Would an explosion on an uninhabited island produce a sound? Or let us put the question differently; if a tree falls on an uninhabited island, does it make a noise?

Seeing that your correspondent, Mr. Cameron, and his colleagues have a taste for metaphysics, I suggest that they ruminate a while on this poser: Would the universe disappear with the death of the last man in it? One must bear in mind in discussing this question that all we know of the world is what has been revealed to us through our senses. Various philosophers through the ages have wrestled with this problem and usually have been heartily glad to drop it.

HARRY SMITH,
Easton, Pa.

IT seems that a great many readers are still inclined to hold an opinion similar to that of the above well informed reader. We have disagreed before and we are here again forced to disagree. Sound is not, as the writer above says, "subjective and not objective." From the standpoint of physics, sound is considered to be chiefly objective, even though it may also be subjective.

Sound is a wave phenomenon and in the human body the frequency of the wave perception is from 16, to about 40,000 vibrations per second. Experiments from station WRNY have indicated that animals were capable of hearing sounds above human audibility range. Now, for the perception of sounds, we require the physiological organs such as the ear, the terminal organs of hearing (not necessarily the diaphragm and the ossicles) the nerves and of course the brain, for analyzing that sound. The external ear itself, the diaphragm and the ossicles, are not essential. Any sound vibration can be conducted directly to the terminal organs of hearing through the medium of the bones of the head. Thus you will find that even if you plug your ears with cotton so that you can scarcely hear any sound, you can hear. Just drive a phonograph needle into a piece of wood and hold this piece of wood between your teeth, you will then be able to hear music on any revolving record.



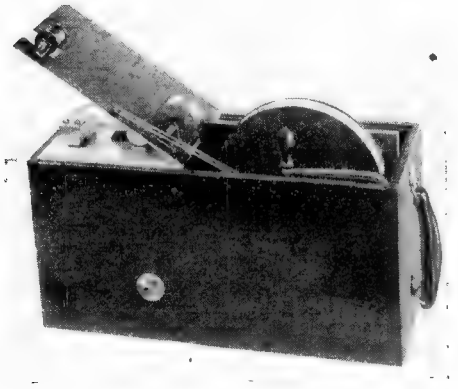
If we place a bell in a jar, and evacuate the jar, then couple the wires leading to the bell with a battery, is that bell producing a sound, even though not heard? The diagram indicates the method of testing.

Mr. Gernsback further demonstrated that sounds could likewise be felt and any physics laboratory will show you that sounds can be translated into bands of light or waves of light, each wave having its own individual characteristic. Thus, the characteristic of a

(*Continued on page* 763)

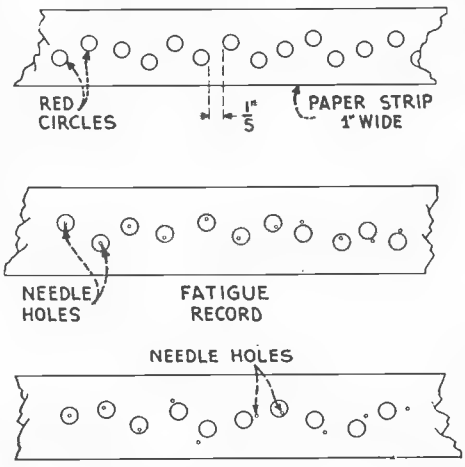
New Machine Charts Fatigue

THE novel device described here provides an efficient and reliable method of studying and registering the amount of distraction of the attention due to mental fatigue or to the influence of any disturbing action on the nerves. A continuous band of paper about 1″ wide is drawn past an opening in the lid of the case, at a speed which can be varied between ⅕″ and 1″ per second. On this moving paper a series of small red circles is marked, spaced equally from each other, but at irregular positions across the width. The test consists in marking with a needle the center of a circle as it passes the aperture, the speed of the paper being so adjusted that the test requires a maximal sustained effort of attention from the subject. The number of missed or imperfectly marked circles then forms an indication of his mental condition at the time. The maximum lateral deviation of the circles on the paper is ½″ and in order that the difficulty in reaching the circles shall not appreciably vary, no two consecutive circles have a lateral deviation exceeding ¼″.



A view of the fatigue recording machine with the cover thrown back is shown in the above photograph. Note the paper strip.

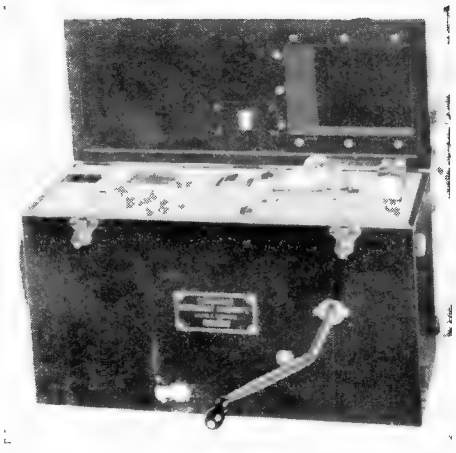
One of the applications of this machine is found in the examination of the concurrent or intercurrent performance of two different mental operations. The procedure is as follows: The speed of the paper is adjusted so that it requires a maximal effort, satisfactorily to mark the centers of the circles when uninterrupted. The subject is now set to mark the circles at this speed, at the same time performing another task, such as the addition of dictated figures, the counting of irregular taps, etc., and the number of mistakes in the dotting of the circles indicates the distracting effect of the concurrent task.



DUAL TASK
ADDING FIGURES AND MARKING CIRCLES

Above we have a sketch showing the paper strip itself and also two fatigue records. The bottom strip shows a dual task record.

In the second application of the machine as a measurer of mental fatigue, or more generally as an indicator of changes in the level of mental efficiency, records may be taken under varying conditions of the mind and compared. The fatigue consequent on the production of many records in succession may be noted, comparisons of the capacity for concentrated mental effort at different times during the day may be made, and the influence of excitement, practice, drugs and rest, may be satisfactorily recorded.



Another view of the machine with the handle in place appears above. The small window beneath which the paper strip moves may also be seen.

A third application of the method is in the determination of differences of individual capacity. The machine is in use also as a means of prescribing a graduated mental gymnastic for the re-education of the will and is thus of interest to physicians.

To overcome the error which would arise due to the process becoming more or less mechanical after continual practice, the subject may be set to mark alternate circles only.

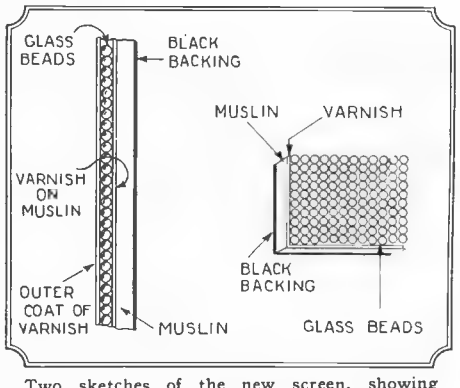
—*F. G. Bailey.*

A Third Dimensional Movie Screen

THE motion-pictures have thus far supplied us with two dimensions, height and width, but depth has been lacking. Many efforts have been devised for creating the all essential sense of depth and proportion in the motion pictures. Such a device has recently been installed in the Roxy Theatre, New York. The screen, an invention of Ludwig A. Wilczek is the first to give the optical effect of the third dimension or depth without the use of two lenses in photography and special apparatus used by the spectator in viewing the picture.

The cardboard-like appearance of the characters on the screen when viewed from certain angles in the ordinary movie is eliminated in Mr. Wilczek's device. No matter from what angle you may gaze on the projected picture, there is no grotesque distortion and the actors appear to the eyes as they would if they were actually present in the flesh. Standing in the wings of the stage, almost in the same plane as the screen itself, it is possible to read the letters of the titles as if they were raised on blocks of wood. Moreover, the eyestrain which affects people over forty years of age when viewing the ordinary moving picture projection is greatly diminished with this new screen.

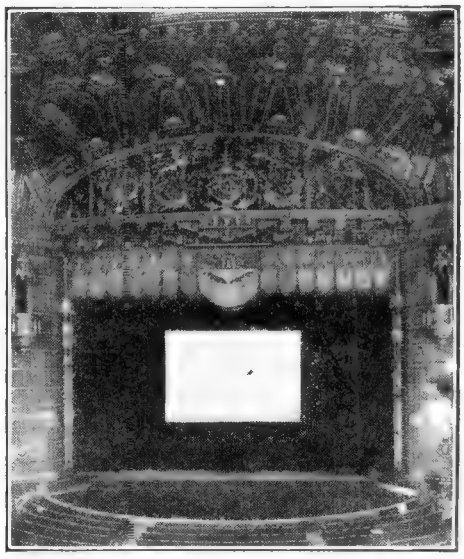
Millions of smooth tiny glass particles, each no larger than the head of a pin, make up the surface of this new third dimensional screen. These clear glass beads form a smooth surface which may be washed. The glass is imported from Germany. Practically all flickering and distortion have been eliminated by this new device and there is a saving of about one-third in the amount of light used in projection. The effect of depth, of course, is an optical illusion. The ground of the screen is a clear white. The body of the screen which is an imported German muslin is coated on the back with a flexible black paint to fill the pores. The glass beads or reflecting elements are imbedded in a coat of transparent flexible varnish, which covers the front of the muslin, and the beads are covered with another coat of the same so that the reflecting elements are imbedded between two layers of the transparent varnish.



Two sketches of the new screen, showing its construction are shown above. The glass beads are placed between two layers of varnish.

On a 110 foot throw, an ordinary screen of its size would require 135 amperes in the arc, but with this new screen better results are obtained with only 85 amperes of cur-

(*Continued on page 773*)



Above we have a photograph of the stage of the Roxy theatre showing the size of the new screen which gives the effect of depth.

The Metal EMPEROR

by A. Merritt

Author of "THE MOON POOL", "THE FACE IN THE ABYSS" etc.

CHAPTER VIII

THE SHAPES IN THE MIST (Third Installment)

DRAKE rolled a cigarette and lighted it. The hand that held the match shook a bit, and its flare betrayed the whiteness of his face. I knew mine had no more color. Suddenly, Ruth crumpled, dropped to her knees, her hands over her eyes.

"Buck up, Ruth," Ventnor bent over her and ran his hands through her hair. "Buck up, old fellow. Whatever we're up against, it's better than the armored men."

"Is it?" wept Ruth. "Is it, Martin? I'm not so—sure."

"Well, I am," Drake crouched beside her. "We know exactly what would have happened to us if that crowd had won out. This interesting lady and her unusual friends who pulled us out of the hole can treat us no worse, that's sure. We're better off where we are than where we would have been if they hadn't turned up. You must admit that, Miss Ventnor."

"In—in a way I do," faltered Ruth. "But wh-what about later on?"

"Later on is—later on," replied Drake, puffing at his cigarette. "A brilliant remark, but incontrovertible. Now at first," he went on with careful casualness, "I thought these things might possibly be automatons, extraordinarily clever and complex mechanisms run by something like wireless. On the same principle maybe as the Hammond torpedo."

"Oh," cried Ruth, forgetting her panic in the interest aroused by this explanation, "you mean they're not—alive—at all. And that Norhala—operates them?"

"Who else?" asked Drake.

"Hm-m!" said Ruth, straightening up, her curly head lifted. "But wait—Norhala was nowhere near when those—babies—raced out of the ruins. And she couldn't have made them do what they did to you and Louis. No, she couldn't. And that dreadful thing that killed the soldiers—why, it just *enjoyed* it! No—it couldn't have been Norhala. Because she wouldn't have enjoyed it. She would just have been calm and emotionless and—well, inhuman about it. But—*it*—had—well, a lot of fun. No, Mr. Drake—it's not Norhala—"

She was silent for a little.

"There's just two sides to it," she said at last. "Either those things are astonishing machines, as you thought. Or else they're—alive. But I'm not afraid any more—so don't worry about me."

"Good!" Ventnor patted her shoulder. "Good for you, Ruth! You're on your feet again, old fellow, and it's my own sister talking. Of course they're alive. Take your idea of the Hammond torpedo, Drake. Could any torpedo break itself into each of its parts—propeller, body, engine and all of it—and then reassemble itself? And, after that, break again and reintegrate in an entirely different shape? Well, that's what we saw that thing in the hollow do."

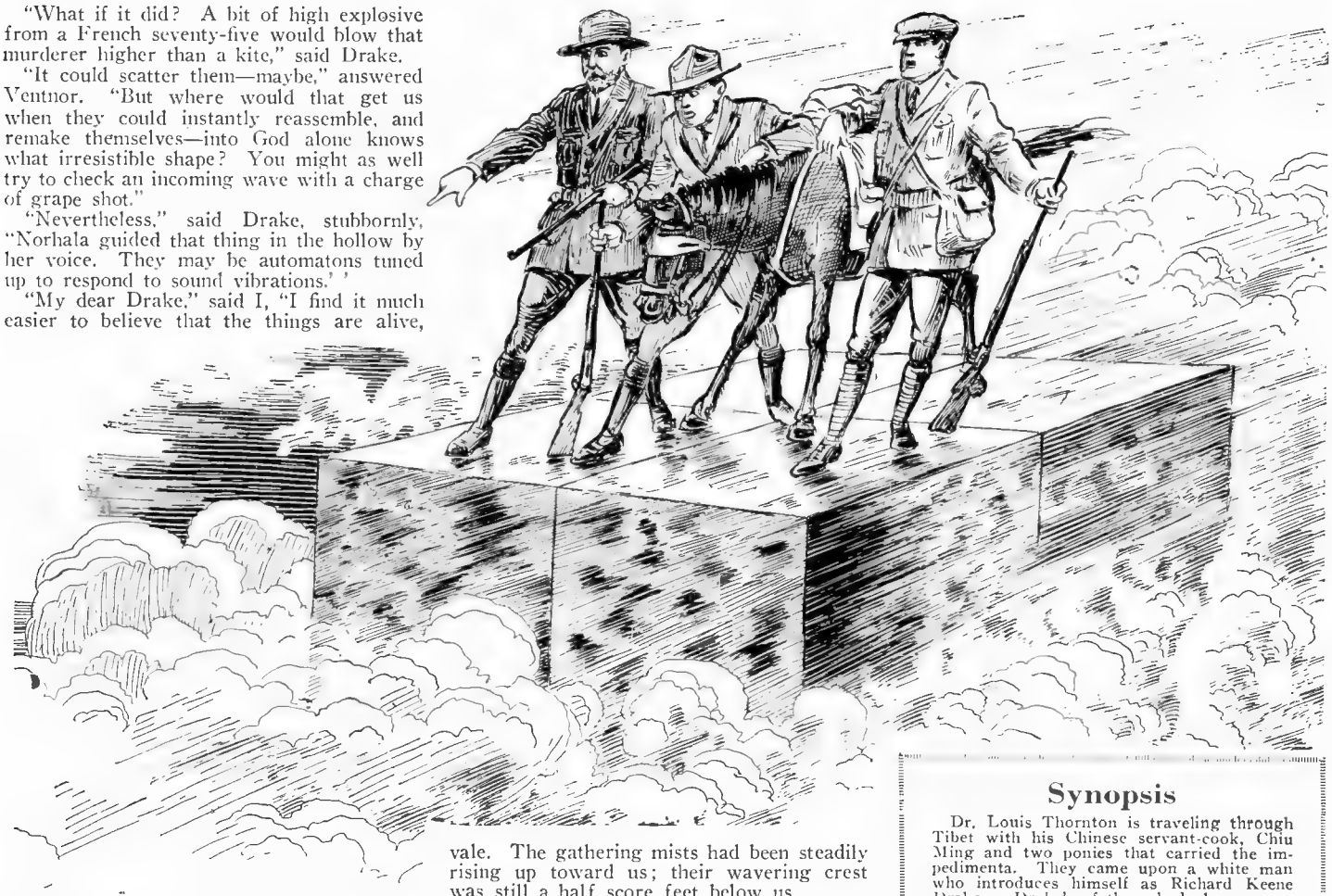
"The block that bore Ruth and Norhala swept away. I saw Ruth crouching, head bent, her arms around the knees of the woman, standing like us, erect. . . . The cubes moved with entire absence of vibration. . . ."

"What if it did? A bit of high explosive from a French seventy-five would blow that murderer higher than a kite," said Drake.

"It could scatter them—maybe," answered Ventnor. "But where would that get us when they could instantly reassemble, and remake themselves—into God alone knows what irresistible shape? You might as well try to check an incoming wave with a charge of grape shot."

"Nevertheless," said Drake, stubbornly, "Norhala guided that thing in the hollow by her voice. They may be automatons tuned up to respond to sound vibrations.' '

"My dear Drake," said I, "I find it much easier to believe that the things are alive,



than that such very remarkable changes and movements which we beheld could be induced by vocal sounds—"

"Alive?" drawled Ventnor. "Of course they're alive, Drake. You are only trying to argue yourself out of that truly terrifying fact. They are volant and thinking things, each one of them. To meet whatever emergency is before them, their separate wills melt into one. They become a thing of interlocked intelligences—harmonious, co-ordinate; a thing with as many brains as it has units—and with all those brains acting as one; a fluid intelligence limited in its strength only by the number of its parts.

"I'm afraid—I'm—deadly afraid," whispered Ruth. She walked forlornly over to the pony. "But whether I am or am not—you must eat."

As Drake jumped to her side, and began to unstrap a saddle-bag, my heart went out to the girl. Terrifying as had been the phenomena through which we had passed, perilous as was our present situation and hedged by mysteries, I felt that we had been moving only through a prelude. Would Ruth be able to endure?

"You needn't worry about me, any of you," she said. "I won't do anything to make you ashamed of me. Only just now, I'm—I'm a little—tumbled up." She drew a hand over the wet blue eyes and smiled up at us. "Well, that's *that*," said Ruth. "Now help me get something together."

We were silent as we drew a spare supper from Ventnor's all too meager store. There was water, fortunately, in the canteens; over the spirit lamp we made some coffee. There was sufficient grain for the pony; we shared the water with it.

The valley was still, as though sound had been withdrawn from it. The shimmering radiance suffusing it had thickened perceptibly. It hovered over the valley floor and hid it. We repacked the saddle-bags and girthed the pony. Silently we awaited Norhala's return.

I had noted that the place on which we stood must be raised above the level of the vale. The gathering mists had been steadily rising up toward us; their wavering crest was still a half score feet below us.

A MYSTERIOUS VISITOR

OUT of them broke a faintly phosphorescent square. It lifted slowly; then swept, a dully lustrous six-foot cube, up the slope. It came to rest almost at our feet. It contemplated us from its myriads of deep-set, sparkling striations.

In its wake swam, one by one, six others—their tops raising from the vapors like the first, watchfully; like shimmering backs of sea monsters, like turrets of fantastic submarines. One by one they skimmed over the ledge, and one by one they nestled, edge to edge against the cube which had come first. In a forty-two-foot crescent, six feet high, they stretched in front of us. Back from them, a pace, ten paces, we retreated.

They lay staring at us.

Up from behind them came Norhala. She drifted over them like some spirit of light, and stood before us. Her veils were about her, golden girdle and sandals of gold and turquoise in their places. She walked toward us, turned and faced the watching crescent. She uttered no sound, but, as at a signal, the central cube slid forward and halted before her. She rested a hand upon its edge.

"Ride—with me," she murmured to Ruth.

"Norhala," Ventnor took a step forward. "Norhala, we must go with her. And this"—he pointed to the pony—"must go with us."

"I meant—you—to come," the faraway voice chimed, "but I had not thought of—that."

She turned to the six waiting cubes. Again as at a command, four of the things moved, and swirled in toward each other. They joined and stood before us, a platform twelve feet square, six high.

"Mount," sighed Norhala.

Ventnor looked helplessly at the sheer front facing him.

"Mount!" There was half-wondering impatience in her command. "See," she caught Ruth by the waist—with the same bewildering swiftness with which she had vanished from us when the aurora had beckoned, she appeared, holding the girl, upon the top of the single cube.

"Mount," she whispered again, looking down upon us.

Ventnor began to bandage the pony's eyes. I placed my hand upon the edge of the barrier and sprang. Unseen hands caught me, raised me, and set me on the upper surface.

"Lift the pony to me," I called to Ventnor.

"Lift it?" he exclaimed, incredulously.

Drake laughed.

"Catch," he called and placed one hand beneath the little beast's belly, the other under its throat. His shoulders heaved—and up shot the pony, laden as it was and landed softly upon four wide-stretched legs beside me.

"Follow," cried Norhala.

Ventnor leaped for the top, Drake beside him. In the flash of a bird's wing they were gripping me. The unseen hold angled, struck upward, clutched us from ankle to thigh and held us fast—men and beast.

The block that bore Ruth and Norhala swept away. I saw Ruth crouching, head bent, her arms around the knees of the woman, standing like us, erect. They slipped into the mists and vanished. After them, like a log in a racing current, we, too, dipped beneath the vapors.

(*Continued on page* 741)

Synopsis

Dr. Louis Thornton is traveling through Tibet with his Chinese servant-cook, Chiu Ming and two ponies that carried the impedimenta. They came upon a white man who introduces himself as Richard Keene Drake. Drake's father had been very friendly with Thornton. The three decide to carry on and come upon Martin Ventnor, a geologist, and Ruth, his daughter. The latter are guarding themselves against hundreds of soldiers who belong to an age at least twenty centuries back. While escaping they are attacked and would have been exterminated, were it not for the timely intervention of Norhala, a tall beautiful metallic-haired woman whose control over lightning and over heavy metallic blocks was phenomenal. These blocks, at her command, would make a bridge for her to walk on or form themselves into battling monsters to protect her or obey her every whim. Chiu-Ming is killed in the battle, the survivors leaving with Norhala.

Can You Answer These Scientific Questions?

SCIENCE & INVENTION Magazine readers, especially our thousands of friends in schools and colleges everywhere, have frequently testified in their letters to the editors that they obtain invaluable help from the columns of this magazine, in clearing up technical questions which arise daily. It is a recognized fact that everyone today, including those of both sexes, are expected to have a fairly good general knowledge of the latest scientific developments and discoveries. It is quite impossible to obtain this knowledge of the latest conquests in science from text-books, as they are usually revised but once a year, and in many cases not as often as that. You will find the questions below a good challenge to your knowledge of modern science, and we advise you to form your own answer, before you turn to the page referred to in each case.

1. How can pure musical notes be produced by controlling electrons in an evacuated bulb? (See page 694.)
2. What metal besides aluminum is used in building German aircraft? (See page 696.)
3. If you were given the assignment to shift the course of Niagara Falls, even slightly; how would you go about it? (See page 698.)
4. Suppose that you had neither receivers nor loud speaker. How could you demonstrate that your radio set is working with but the aid of a dishpan and your fingertip? (See page 725.)
5. How much greater is the light-gathering power of a 300-inch telescope, as compared to a 100-inch telescope? (See page 703.)
6. If a tree fell in a forest and no one was there to hear it; or, again, if you had no ears, would there be any noise? (See page 704.)
7. If you were given an order for a movie screen which would cause the pictures to stand out in relief, how would you go about designing the screen? (See page 705.)
8. Is it possible for a police whistle to be blown, and also heard by another policeman, and still bystanders could not hear it? (See page 709.)
9. Will you weigh more, or less, one hour from now? (See page 710.)
10. Can you describe briefly just how to overhaul the rear end of an automobile? (See page 712.)
11. How would you attempt to photograph the sun or the moon without a telescope? (See page 718.)
12. How would you design an emergency radio set for a plane like Ruth Elder's, and how would you elevate the aerial, once the plane landed on the water? (See page 723.)

The Astrology Humbug

By JOSEPH H. KRAUS

PRACTICAL ASTROLOGY

Editor, SCIENCE AND INVENTION:

I was much interested in your articles in SCIENCE AND INVENTION condemning astrology. As to your dictum that "astrology is not a science," I think that such a remark is far too sweeping. If you had said that astrology is not an exact science, one could more readily take a sympathetic view of your standpoint. For (outside of mathematics) there is no science wherein we can be quite sure of what can, or cannot occur. I am not an astrologer. I am a farmer, having been farming for myself now for about 24 years. But I have made a special study of astrology, as a hobby, for the past 18 years or so. I quite concede that one cannot always foresee events as they actually occur; but from my own experience, I know that it is possible to outline the nature of the planetary influences operating at any given time, in accordance with the well known nature of the planets involved in the matter. For instance, we can always expect the weather to be cool and wet, with Venus and Saturn strongly aspected; just as we can look for warmth from aspects of Mars and Jupiter, and high winds from Mercury and Herschel (that is with no counteracting influences at the same time to modify the effects). And similarly with national or individual affairs. Seeing that the idea of astrology is obviously based on the alleged influence of the planet, etc., in accordance with their aspects and positions in the various signs of the Zodiac, one cannot help but think that those who haven't studied the matter, and probably cannot give the names of the signs in their proper order, or the names of the planets either, have really no moral right to hold any opinion in the matter. Or if we are to take the attitude that we must not place any credence in anything because we do not understand it, or know how it works; we come to so many things we don't understand, that we only realize how very limited is our understanding. Electricity is a common thing now; we can see the effects of electric power on every side. But no living scientist can tell us how it works. Yet any man who does not believe in electricity because he does not know how it works would be called a fool. Do you get the point? Regarding your invitation (or challenge) to any astrologer to predict three "major events," one point upon which one might have doubts is just what would count under that heading. There have been quite a few things occurring this season, of which one could have readily made predictions; such as the unusual vagaries of the weather, severe storm periods, short crops in some localities, the difficulties at Geneva, etc., but the drawback was the doubt as to whether such happenings would be accepted as major events. However, on a survey of the more prominent planetary phenomena of the past year, there are plain indications of coming events casting their shadows before, the fulfillment of such in some cases pointing to the year 1928 instead of this year, which would seem to bar them out of consideration in this case. But there are a few matters of which one may reasonably make forecasts of developments in the near future, especially relating to (1) King George V, of Britain; (II) the Panama Canal, and (III) the Washington Conference; as follows:—

King George V.

June 3, 1865; 1.18 A. M. (Greenwich T.) 51°. 30'. North Lat. 0°. 0'. 37". West Long:

An important planetary conjunction occurred this summer; that of Jupiter and Herschel, in the third degree of Aries, which is right on the ascendant of King George V. This will in due time bring a train of troubles and changes to bear on him. Seeing that the solar eclipse of December 24, 1927 in Capricorn 1° will be right on his Meridian, it looks as if he will soon experience the truth of the old maxim that "troubles come in bunches." Besides, the conjunction of Mars and Saturn on December 26, 1927, in Saggitarius 13° will be in opposition to the Sun in his horoscope. There will likely be serious trouble with foreign affairs, and perhaps sickness about December 22, 1927, and a few days following that date. In fact, a critical time will come before then; for the new moon of September 25, 1927, is in opposition to Herschel on his ascendant. This will bring great difficulties that will need all the skill and tact that he can bring to bear, to successfully surmount them. October 9, 1927 will be a bad time, and the week following that date. Besides diplomatic complications with other powers, his health will not be good at that time. Some one of his sons will cause him much worry over either hurts or youthful escapades.

(*Continued on page 761*)

$6,000.00

For Proofs of Astrology

SCIENCE AND INVENTION Magazine holds that there is nothing scientific in Astrology, that Astrology is not a science and that statements made by astrologers unless very general cannot be entertained seriously.

Accordingly, this publication has decided to award an Astrology Prize of $6,000 for the following:

$5,000 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

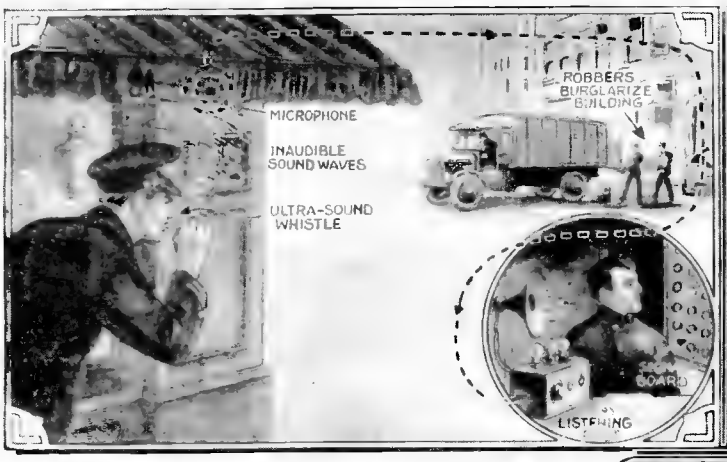
$1,000 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people whose initials will be given him when he requests the same and the birth dates and place of birth will also be supplied by this office.

This contest closed October 1st, 1927, and further announcements will be made.

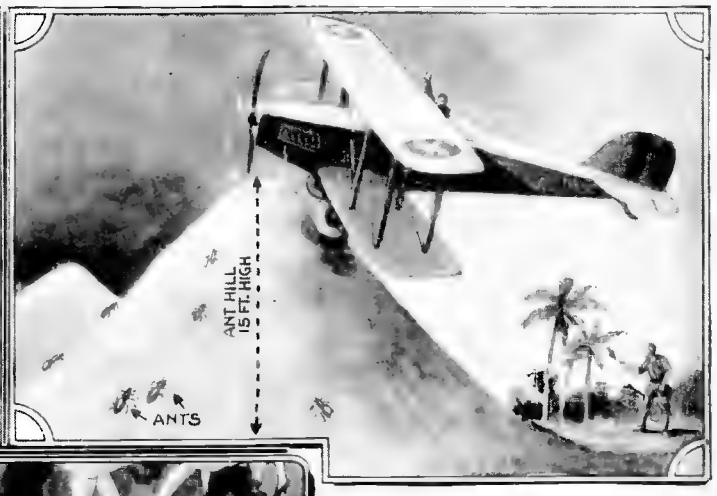
Address all entries to Editor, Astrology, care of SCIENCE AND INVENTION Magazine, 230 Fifth Avenue, New York, N. Y.

The Month's Scientific News Illustrated

By GEORGE WALL



Police officers in France have been equipped with whistles which emit sounds above audibility. These inaudible sound waves are picked up by a microphone and are led to listening posts where sensitive receivers and a bank of amplifiers are situated. Thus, a means of secret communication is provided whereby aid can be summoned without alarming the criminal at his work. These vibrations are inaudible sound waves or air vibrations, not vibrations of the ether. Research on high frequency air vibrations has already been carried on in many directions.



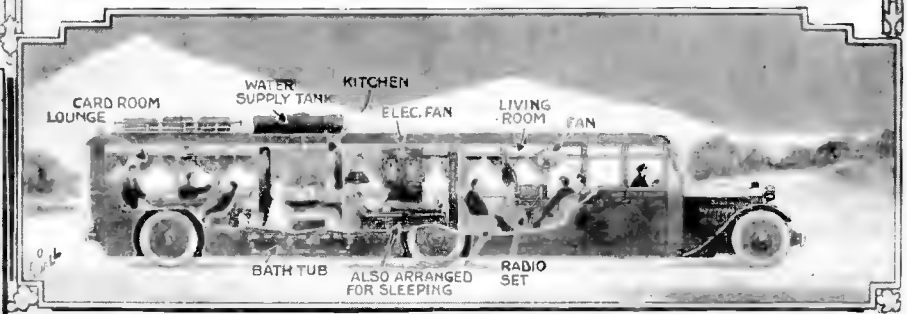
An ant hill was responsible for the wreck of an Army airplane in Panama recently. The Army Plane collided with the ant hill when taking off in Anton Province, Panama. Luckily the pilot was uninjured. The ant hills in the interior of Panama and adjoining countries often attain the surprising height of ten to fifteen feet. Two American planes flew from France field to Anton and repairs were quickly made.

Delegates of the National Fraternal Society of the Deaf recently danced to the music of a jazz band which none could hear. A wooden floor was used and the dancers received the music through the vibration of the floor. Stone or concrete floors could not be used.

A runaway glacier in Deming, Washington, recently crashed its way down the side of a mountain, doing $50.000 worth of damage before it came to rest. Boulders and railroad tracks were thrown aside as if they were toothpicks. Huge stones, weighing several tons were lifted and deposited on tops of hills. The piece of ice was one mile in length, sixty feet thick on its narrowest edge, and from three hundred to six hundred feet in width. Just what caused the slipping of the moving ice river is difficult to say, but the suggestion of a slight earthquake seems credible.

EXPRESS AUTO HIGHWAY SOUTHBOUND IN THE MORNING AND NORTHBOUND IN THE AFTERNOON
AUTOMOBILE TRAFFIC 40 TO 50 MILES PER HOUR
PUBLIC GARAGES
HUDSON RIVER PIERS
RAPID TRANSIT GOING NORTH
GOING SOUTH
BRIDGE
RAMP

Dr. Benjamin F. Battin has advanced the plan of an eight story road from 72nd street, down to the Battery, along the North River, in New York City. The street level and the first story are connected with all the piers on the Hudson River. The second and third stories are used for rapid transit, electric trains; one level going North and the other going South. The fourth and fifth stories are used as public garages. The sixth and seventh stories are to be used for automobile traffic; uptown on one level and downtown on the other, with a width suitable for four or five cars abreast.



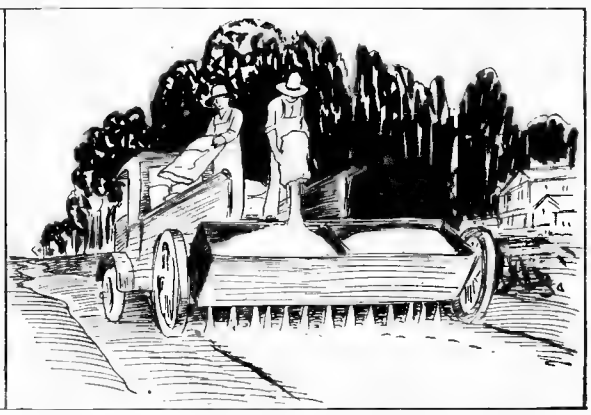
The highway motor yacht is being introduced in England. These cars are thirty-nine feet long and have six wheels. The accommodations include a dining room, a bathroom fitted with hot and cold showers, bedrooms with tables, reading lamps, electric fans, wardrobes and silk shades. In the lounging room a radio set and phonograph are installed. These runabouts cost about $15,000 each, which prevent them from becoming a traffic nuisance. The personnel consists of two men who act as butler, valet and chauffeur.

British entomologists are planning to make London the world's bug center, from which flying squads of insects can be rushed to any part of the empire to fight crop pests. The Empire Marketing Board which handles the British Empire's agricultural problems plans to grow beneficial parasites which will attack boll weevils, potato bugs and similar insects destructive to crops. These bugs will be launched against the destructive insects, thus saving many millions of dollars which are lost yearly, due to harmful insects.

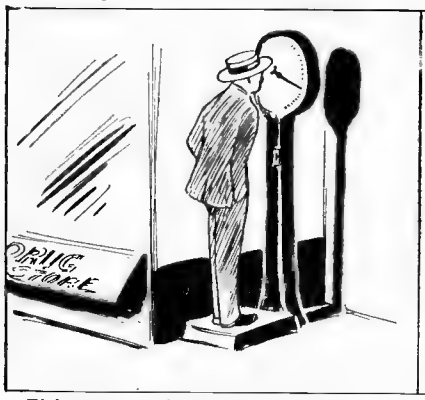
Everyday Chemistry

Hydrogen sulphide gas, which has the odor of rotten eggs, is sometimes used to cause the invisible spirit-writing to appear at Fortune Tellers.

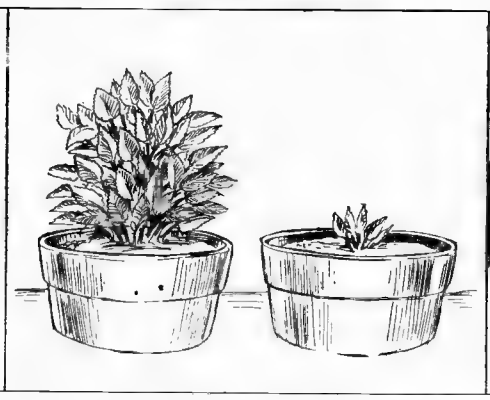
The bubbles in the water of the fish globe are oxygen, and it is this gas which the fish breathe. Without this gas they would drown.



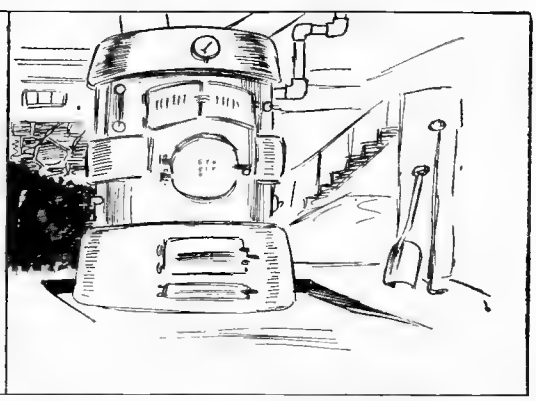
Calcium chloride is now being sprinkled on roads, where it absorbs water from the air and remains moist, settling the dust for many months.



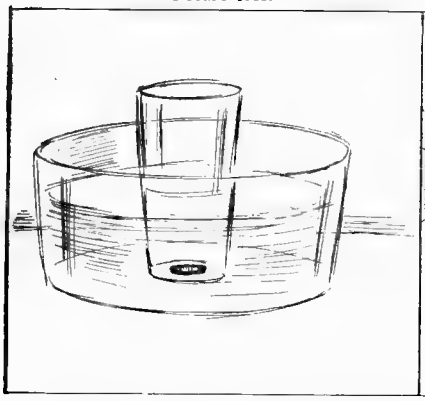
Elaborate metabolism experiments have recently shown that one hour from now you will weigh one ounce less, due to moisture loss.



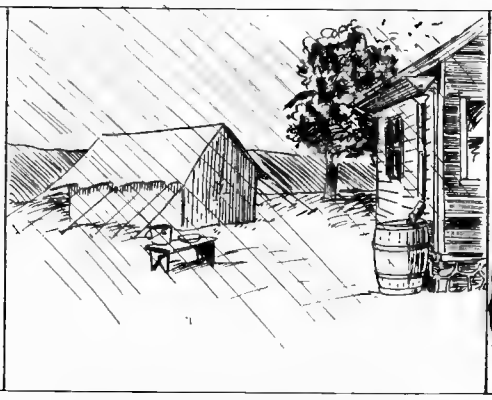
Some chemicals sprayed on potatoes will cause them to sprout much earlier. Such chemicals include thiocyanates, ethylene and chlorhydrin.



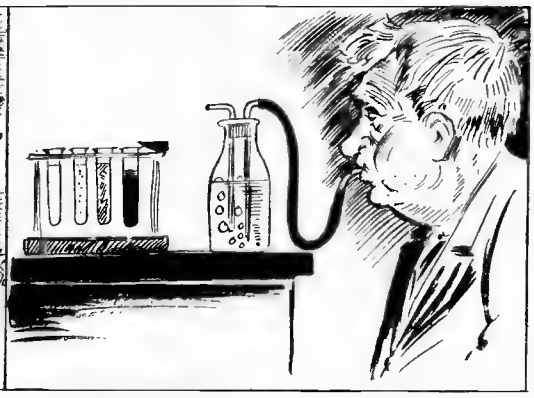
Water has certain disadvantages when used in boilers. Mercury has been tried. Diphenyl-oxide has been used and high efficiencies are claimed for it.



Expose a bright piece of copper to the gasoline you use, for one hour. If it becomes discolored, the gasoline contains objectionable sulphur compounds.

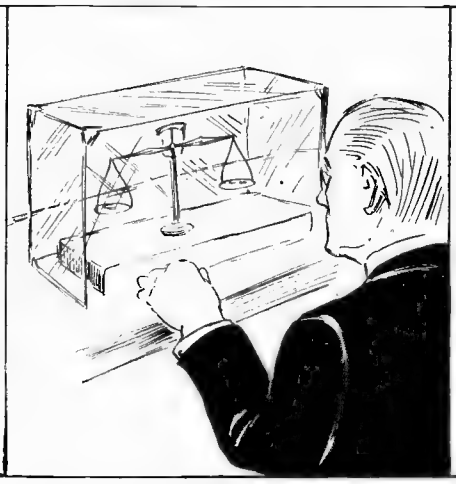


Crystals of potassium permanganate, added to the rain water barrel will prevent mosquito formation, but the water is very poisonous.

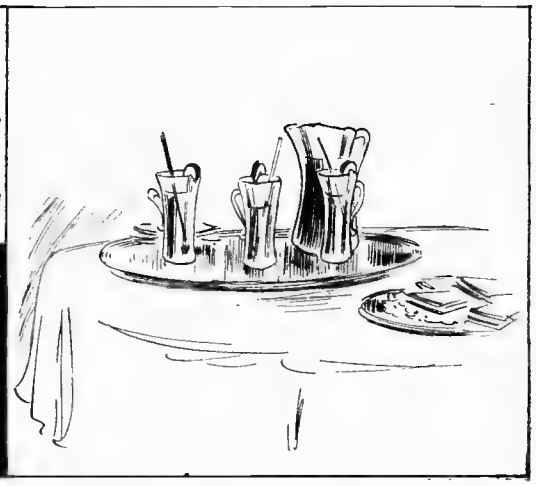


Alcohol vapors, blown through bichromate of potash will cause a change in color, showing how much alcohol has been absorbed by the system.

Sunburn produces brown granules in the skin, which gives it the dark color. These granules are due to the formation of melanin.



Only two countries in the world do not use the Metric system. They are Great Britain and the United States.



Boiling tea extracts tannic acid from the leaves. Steeping the leaves will cut this acid extraction to a minimum.—R. B. Wail-

MAGIC By "DUNNINGER"

HIPPODROME-Tonight
DUNNINGER
DUNNINGER AMAZES TRIBUNE EMPLOYEES IN DEMONSTRATION
Joe Dunninger Tells How Prince Got Trick to Show Home Folks
HYPNOTIST RULES SUBJECT BY RADIO
Reads Mayor's Inner Mind

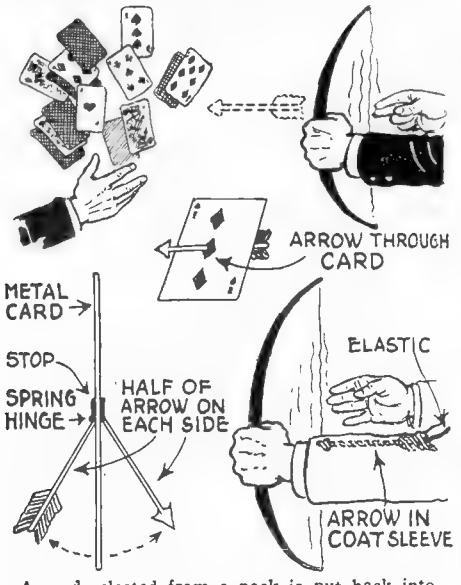
THE MAN WHO MYSTIFIED

Pres. Coolidge
Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION

Folks Are Mystified Yet Delighted by This Man!
DUNNINGER ASTONISHES COMMITTEE IN LIBRARY TEST OF MIND READING
Mind You! The Mind Reader Really Read the Mayor's Mind
DUNNINGER DRAWS MORE BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

NO. 57 OF A SERIES

MYSTERIOUS MARKSMANSHIP

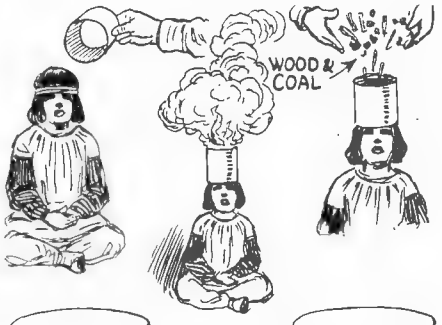


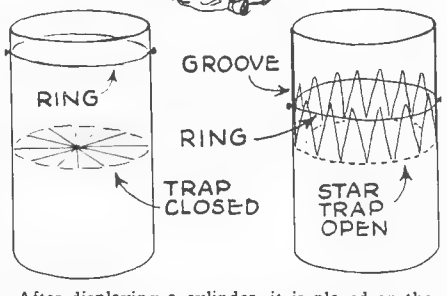
A card selected from a pack is put back into the deck, the deck shuffled, tossed into the air, and while the cards are flying, the magician shoots an arrow through them. The selected card is found pierced with an arrow.

The magician permits any member of the audience to select a card from a pack, return it and shuffle the deck. Standing a short distance away from his assistant, he aims a small bow and arrow in the assistant's direction. At a signal, the assistant tosses the cards into the air as the wizard releases the arrow. The selected card is found with the arrow clear through its center. In the operation of the effect, the card is forced. A duplicate made of tin has two sections of an arrow hinged to the center as the drawing indicates. This fake is secreted in the pack and opens when the cards are tossed in the air. The real arrow disappears up the sleeve.

A HINDU PHENOMENON

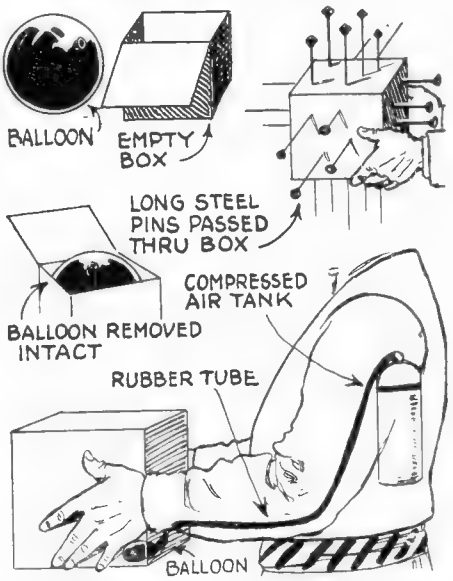
If the wizard is presenting an Oriental performance, this effect will be of unusual interest to him. He first displays the cylinder, allowing the spectators to see through it. This cylinder is placed over the head of an assistant; paper, wood and coal added and a fire is started. Eggs are then fried in a pan over the flame. The tube is so arranged that a star trap is contained within it. As it is placed on the head of the assistant, the star trap is released and it folds down, making a bed for the fire. The trick must be presented quickly so that the mechanism does not get too hot. The pan puts the fire out.





After displaying a cylinder, it is placed on the head of the magician's assistant and coal, wood, and other inflammable materials are thrown into the open end of the tube. A fire is then started.

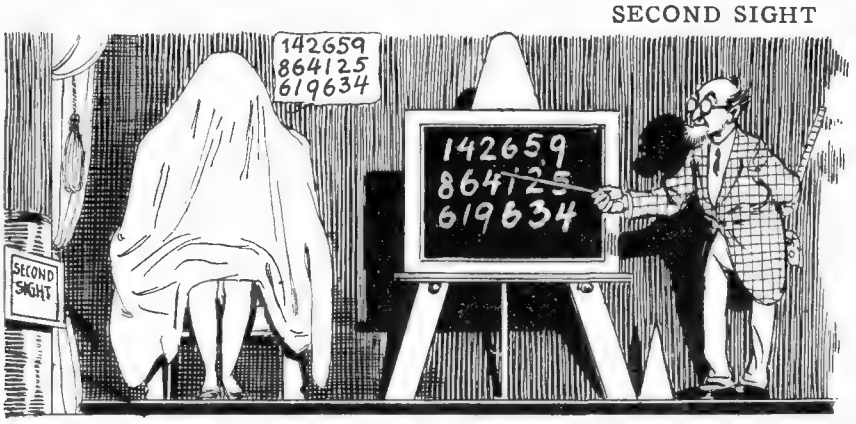
THE ENCHANTED BALLOON

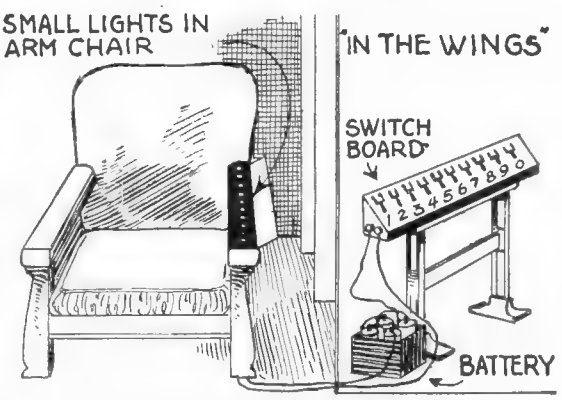


A balloon is placed in an empty cardboard box, the cover closed, and the box pierced with long hat-pins. After the hat-pins are removed, the balloon is shown intact.

A toy balloon fully inflated, is placed in an empty cardboard box. This box is just large enough to hold the balloon firmly. The lid is closed, and a number of large steel hat-pins are passed through the box, apparently piercing the balloon. The hat-pins are then removed, and the balloon will be found intact. The secret lies in the fact that two balloons of identical appearance are employed, both being equipped with valves. The first is pierced when the steel pin is thrust through it. The second in the box is inflated as the pins are being removed.

SECOND SIGHT





A lady medium blindfolded and covered is seated upon a stage, facing the audience. Nevertheless, she is able to add sums of figures and call out any number which any member of the audience may write upon the blackboard. Multiplication, subtraction and division are easy for her. Her hands may be exposed if desired, proving the effect mental. Actually, the system is operated from the wings where an assistant with a comptometer performs the necessary operations in addition, subtraction and division. In front of him are a series of switches or preferably push buttons which operate miniature lights, coverable by a flap and set in the arm of a chair.

MOTOR HINTS

Conducted by GEORGE A. LUERS

DO YOU KNOW—

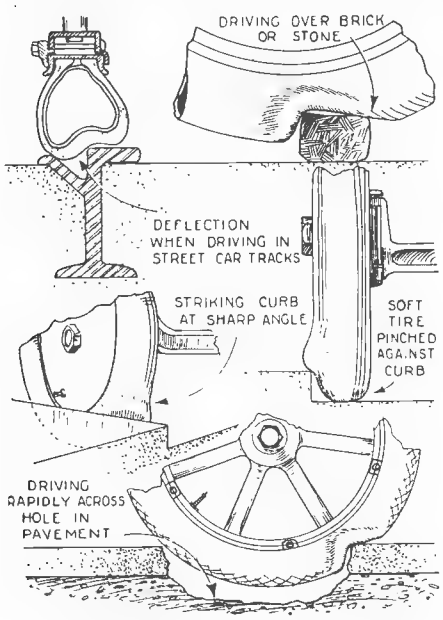
cylinder blocks and heads are frequently warped. Clearance at the valve stems should be made the final adjustment after tightening down all bolts, thus avoiding the difficulties of valves being off their seats.

CAUSES OF BLOWOUTS

The tires of the car are the most used and abused of all the equipment, being subject to the heat of hot asphalt, the sharp edges of broken stone on roads and the damaging effect of being driven over frozen rutted roads, that grind off the rubber down to the carcass of the tire.

Premature blowouts are the most costly difficulties. These cannot be repaired well enough to insure the full service of the tire.

The main causes of blowouts are undue stress, brought about through the following causes, or else others which produce equivalent strain on the carcass under the rubber.


DRIVING OVER BRICK OR STONE
DEFLECTION WHEN DRIVING IN STREET CAR TRACKS
STRIKING CURB AT SHARP ANGLE
SOFT TIRE PINCHED AGAINST CURB
DRIVING RAPIDLY ACROSS HOLE IN PAVEMENT

Some of the many causes of blowouts are shown in the illustration above.

Driving on street car tracks, which bends the bead section.

Driving over a brick or rock in the road at high speed.

Striking the curb of the street with the wheel at a sharp angle.

Pinching an under inflated tire against the curb when driving against it.

Driving across a hole in the pavement at high speed.

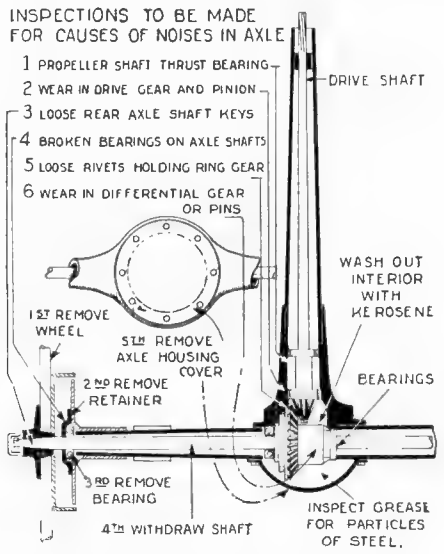
Driving with tires underinflated, even to the amount of ten pounds.

Driving the car several blocks on a flat tire.

Avoid these practices, if you would avoid tire troubles. The fracture resulting from such abuse, may not show in the rubber, but the underlying cords will surely break.

OVERHAULING THE REAR AXLE

An overhaul of the rear axle of the car does not essentially require the entire unit to be removed and broken down piece by piece on the bench, but for all practical purposes of the motorist, it requires inspection, cleaning and renewal of such parts as are defective.

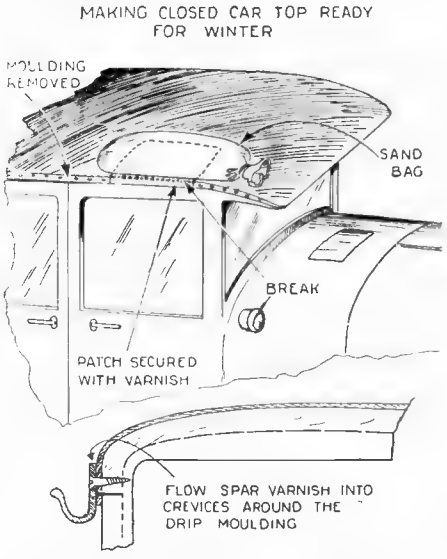

INSPECTIONS TO BE MADE FOR CAUSES OF NOISES IN AXLE
1 PROPELLER SHAFT THRUST BEARING
2 WEAR IN DRIVE GEAR AND PINION
3 LOOSE REAR AXLE SHAFT KEYS
4 BROKEN BEARINGS ON AXLE SHAFTS
5 LOOSE RIVETS HOLDING RING GEAR
6 WEAR IN DIFFERENTIAL GEAR OR PINS
DRIVE SHAFT
WASH OUT INTERIOR WITH KEROSENE
1ST REMOVE WHEEL
5TH REMOVE AXLE HOUSING COVER
2ND REMOVE RETAINER
BEARINGS
3RD REMOVE BEARING
4TH WITHDRAW SHAFT
INSPECT GREASE FOR PARTICLES OF STEEL.

The above drawing shows the causes of noises in the axle and the parts which should be inspected.

After twenty thousand miles of service, it is possible the bearings may be chipped, the edges of the drive pinion, ring gear or differential gears may be broken. In some instances, it is only necessary to remove the small particles of broken metal, so these will not be picked up in the grease and rolled between the gear teeth.

To overhaul the rear axle, it should first be raised and supported on blocks or jacks. The rear wheels should be removed and the bearing retainers at the ends of the shafts should be taken off.

The axle can then be pulled out, allowing inspection and renewal of end bearings.


MAKING CLOSED CAR TOP READY FOR WINTER
MOULDING REMOVED
SAND BAG
BREAK
PATCH SECURED WITH VARNISH
FLOW SPAR VARNISH INTO CREVICES AROUND THE DRIP MOULDING

The car top should be overhauled for winter use as shown above.

The inside of the housing should be washed out with kerosene, applied with both a small bristle brush and an old sponge.

The inside of the axle housing should be examined for small particles of bright metal, which would indicate broken gear teeth or other parts which may be fractured.

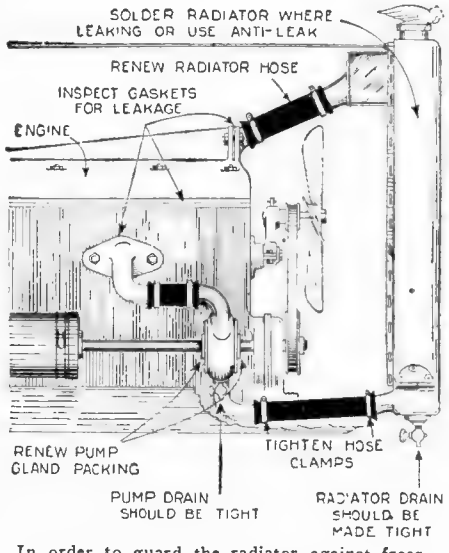
The differential unit should be pried from side to side to show lost motion.

If the axle has given any evidence of noise, the six reference points in the sketch should be inspected, making renewals or repairs as required. On reassembly of parts, the housing is filled with fresh grease.

TREATING CLOSED CAR TOP

It is essential that precautions be taken to seal all small leaks in the top fabric and around the moldings, prior to winter.

If the top fabric is broken at any point along the molding, it should be repaired. To do this remove the molding at this place, insert a new piece of top fabric, so the old material will lap about three inches. Brush varnish between the surfaces to be joined and after allowing to partly dry, lay a small bag of sand on the joint and allow to dry for two days. If the break is above the molding, the same patching procedure is used, by removing the molding to place the patch underneath. When holes are closed, the top should be given a thorough coating of good top dressing. The following day a heavy coat of good spar varnish should be applied over the entire top, working the varnish well down into the crevices around the drip molding.


SOLDER RADIATOR WHERE LEAKING OR USE ANTI-LEAK
RENEW RADIATOR HOSE
INSPECT GASKETS FOR LEAKAGE
ENGINE
RENEW PUMP GLAND PACKING
TIGHTEN HOSE CLAMPS
PUMP DRAIN SHOULD BE TIGHT
RADIATOR DRAIN SHOULD BE MADE TIGHT

In order to guard the radiator against freezing, the hints given above should be followed.

PREPARING THE RADIATOR FOR ANTI-FREEZE

November and December brings with them cold weather and possibilities of frost. The radiator must be filled with a suitable anti-freeze solution.

There are several anti-freeze solutions on the market, but the most popular seem to be glycerine and alcohol. The others contain chemicals, and these should be discouraged for the reason that the powerful chemicals

(Continued on page 732)

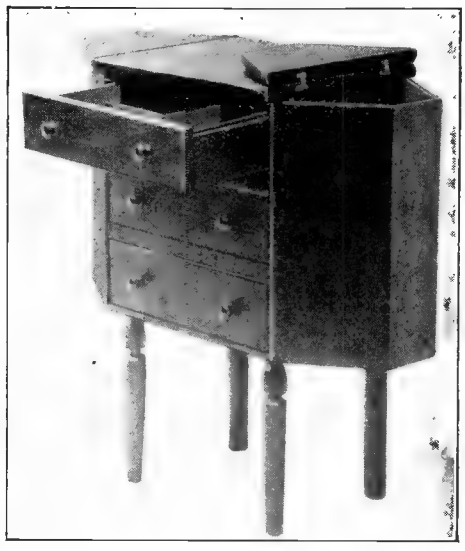
Making a Martha Washington Sewing Cabinet

By HARRY W. BECKWITH

This Attractive Sewing Companion Made at Small Cost

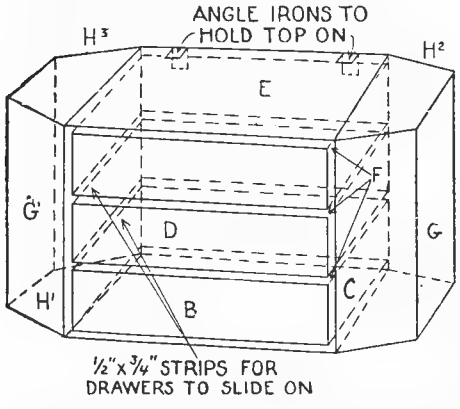
A front view of the Martha Washington sewing cabinet is shown in the above photograph.

The completed sewing cabinet is shown here. Note the two compartments which are arranged on either side of the body.



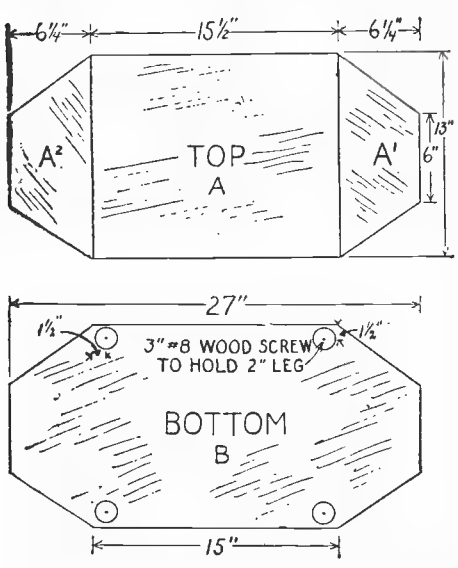
Another view of the completed sewing cabinet appears above. The drawer has been left open so that the construction may be seen.

FOR the first step in the construction cut out of three-eighths inch cypress according to measurements the bottom B. Then cut out C, D and E and mount in box form on B, fastening with wire nails through bottom B. Then cut drawer dividing strips out of the one inch pine, cut these



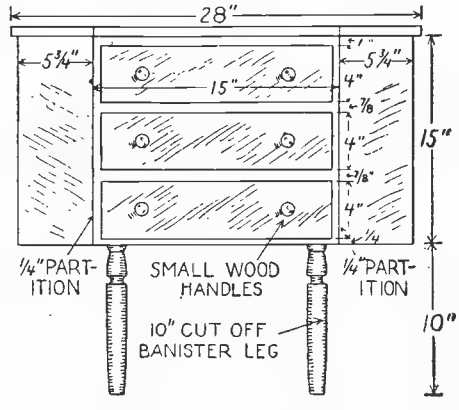
Above the assembly details of the cabinet are shown. All letters given here correspond to those in the text.

strips fifteen inches long by three inches wide and mount on box form as per diagram, using wire brads to hold them in place. Next cut strips G and G¹ out of three-eighths inch cypress and mount on bottom B using brads. Now cut sides H, H¹, H² H³ out of same lumber and mount on bottom B using brads through B, also through sides of box where possible, between H and G glue firmly and on the top where G and H meet use corrugated metal non-splits. Now cut top A out of one inch pine according to outside measurements then saw off A¹ and A² which will be hinged as covers to outside compartments. Top A fastens on to box form by wood screws through the top drawer strip J and with two small angle irons from back of box to top. Now three drawers are to be cut out, the fronts of each drawer to be fifteen inches long and four inches wide of one inch pine. Bottom side and back of drawer are cut out of ⅜ inch cypress. Partitions to be put into drawers as desired. Legs can be made by taking bannister uprights and cutting off ten inches, these are fastened to bottom by 2-½ inch wood screws and glue. The top of the Martha Washington cabinet, the fronts of the drawers and the partitions between them are made of one inch pine, all the other parts are made out of ⅜ inch cypress. The finished cabinet should be carefully sand papered, first with coarse paper and then with fine. It is now ready to be stained and waxed.

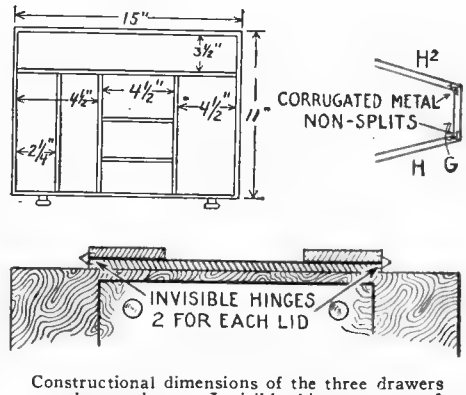


Details and dimensions of the top and bottom are shown above. These portions of the cabinet are made of one inch white pine.

The cabinet can be stained in any desired color to suit the individual taste and should then be given a waxed finish. A cabinet of this sort may be built at the small cost of five to ten dollars, depending upon the kind of wood used, and will find a welcome place in the home. The outside compartments are covered with hinged lids which are held in place by two invisible hinges. The lumber required for the construction of the Martha Washington cabinet is as follows: 5 ft. of finished white pine 14" wide or 4 ft. of pine 16" wide, 18 ft. of ⅜" finished cypress 14" wide, 4 oak bannister uprights for the legs, stain and wax for the finished product. The following tools will be found useful in the construction of this cabinet. One cross cut saw, one medium hammer, one smoothing plane, one square, one screw driver, sand paper fine and coarse. Much time is saved in the construction of this cabinet by making the legs from bannister uprights. These are about 10" high and are fastened to the bottom by 2½" wood screws and glue. The top is fastened onto the box by wood screws and small angle irons. The drawers are held together with small brads and glue. The bottom, side and back of the drawers are made from the ⅜" cypress. The partitions are put into the drawers as desired by the builder. The dividing strips are fastened to the box with wire brads and glue. When gluing the cabinet it is advisable to place a weight on portions to be glued and allow the whole to stand overnight.



Constructional dimensions of the sewing cabinet are shown in the above drawing. The four legs are made from oak bannister uprights.



Constructional dimensions of the three drawers are shown above. Invisible hinges are used on each of the two top lids.

MODEL DEPARTMENT

Building a Model of the U. S. Brig of War "Truxton"

By WILLIAM A. CROSBY

PART V

(*Concluded from the November Issue*)

FROM the ends of these topsail yards, a thread is run up to a pulley (bead) and wire arrangement located just below the topmast top, one on each side, arranged just as for the lower yards, 43. This thread from the bead runs down to the fife rail on deck. The same process is repeated on the main topsail yard.

The ropes which run from the ends of all yards to hold them square, are called the braces. On the lower yards, they are the ropes which run back to the bumkins.

On the topsail yards, the braces of the fore run aft and the ones from the main topsail yard run forward. The forward one is rigged as follows. The end of the line is tied to the main cap and thence runs forward to the little white bead which should be secured to the wire eye at the end of the fore topsail yard. After passing through this bead, the brace leads back again to the main top where another pulley (bead) is wired in place. The brace leads through this and then down to the main fife rail. Of course the same procedure is followed in rigging the brace at the opposite end of the fore topsail yard.

The main topsail yard is rigged in similar manner with the process reversed. The brace starts at the fore cap, runs back and through a bead at the end of the main topsail yard, thence forward and through another bead attached to the after side of the fore top and thence down to the forward fife rail. The process is again repeated for the brace on the other end of the main topsail yard.

As we go aloft, the yards become shorter and somewhat thinner in diameter. The next set of yards are known as the topgallant yards, fore and main, and each is located directly on top of the topmast caps of their respective masts. Each has the wire eye in the center and two arranged at the ends. The eye in the center being connected with light thread this time instead of chain, the wire running up the fore side of the masts and through a hole just below the point where the forestays run down. From here the line is led through these holes and down the after side of the masts, one end being connected to the starboard rail and the other having a bead in it and so arranged that it will lead to the port rail with a double line, much after the manner of the halyards for the lower yards.

The lifts run from the ends of these yards, to beads arranged on the topgallant masts just below the head stays and after passing through these they run all the way down to deck and are secured to the fife rails. Of course there are two such lines arranged for each yard, making a total of four for the two topgallant yards.

The braces for the fore topgallant yard are arranged to run from the ends of the yards, aft, to the main topmast top, where a bead is arranged through which the line is led down to the main fife rail. The same thing is done for the brace at the other end of the fore topgallant yard.

In rigging the braces for the main topgallant yards, the process is just reversed, the braces leading forward to pulleys arranged in the fore topmast top and thence down to the fore fife rail.

The royal yards come next above these and they are "housed" on the topgallant masts just above the head stays. The halyards, from the centers, lead up and through a hole in the mast and thence down to the topgallant mast tops and not to the deck.

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the January contest must reach us on or before the 25th of October.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Ave., New York City.

All the rigging on these yards is led only to the topgallant mast tops. The lifts are arranged just as for the other yards and the braces are similar to the topgallant yards except that the pulleys or beads will come just below the royal yards and not in the tops.

In arranging the braces for the royals and the topgallant yards, be sure that there is no interference between the braces for they should not touch each other. By arranging one set and then placing the others, it is an easy matter to have them miss by a little bit.

On the old ships, such as the "Truxton," it was customary to dress ship every day in port by squaring the yards. You must do this if you are to have your ship look well. The yards should all be absolutely horizontal to the water line and also at right angles to the masts and one yard out of square will most effectively ruin the appearance of the entire ship.

In the old days, the bo'sun used to row out in a small boat and shout orders to the crew until all the yards were squared properly and to his satisfaction.

If you wish you may add yet another set of yards, the skysail yards, but although the "Truxton" carried these on occasion, they were not the usual thing. They will add but little to the finished model and in fact they may actually detract from it for the simple reason that it will appear topheavy. The rigging will also be complicated somewhat and the topgallant masts will look overloaded.

You should go over every knot on the model with a little bit of glue so that they will hold. Where the lines have come to the belaying pins each should be lightly glued and the ends cut off. Be sure also that all knots, after the glue is dry, have their loose ends cut off as closely as possible because there is nothing that makes a model look clumsier than these rough ends showing. If you wish you may coat the yards with shellac (white) which will not show and will add a nice lustre to them. Some people prefer to have a shine to the hull and white shellac will do this also, but personally we prefer to have it dull. The deck should be thoroughly cleaned with a small brush, the loose ends being picked up with the end of your finger slightly moistened.

The base should be finished up neatly and given a coat or two of black paint and if you wish you may print a neat card with the ship's name and the date of her building (1842) which can be glued to the base and the entire thing shellacked over to keep it clean.

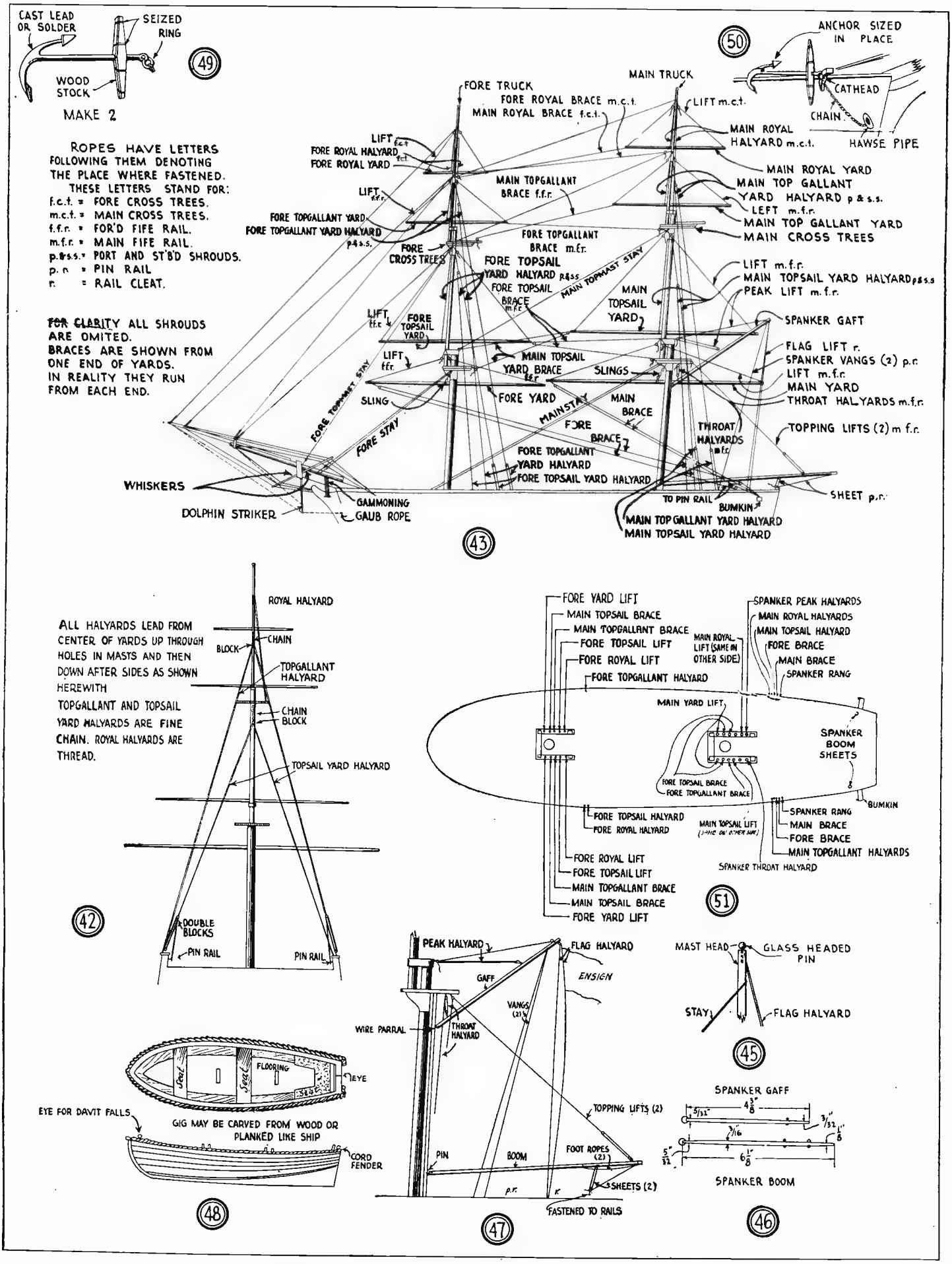
A small hole should be bored at the very top of the masts and into this a glass headed pin is thrust so that the top of the masts will have a little ball on them, 45. This is painted white to correspond. A cross hole may be also bored in the very top of the masts into which a light thread may be pushed and led down to the deck for a flag halyard. Similar halyards are also arranged at the ends of the main yard.

The spanker is the last to go in place and it was carried by two spars of wood known as the spanker gaff and the spanker boom, 46. These run out from the after side of the main mast. The boom should be cut to shape and painted to correspond with the yards. The inner end has a small pin driven into it and the head cut off and then filed to a point. This is then glued and driven into the after side of the main mast at a point just clear of the pump and the boom is lifted up so that it will just clear the top of the steering wheel, 47.

It has two pieces of thread which run from a point just about even with the stern of the vessel to beads arranged on the after side of the main top and thence down to the fife rail. These are known as the quarter lifts and hold the boom up. Sheet ropes

(*Continued on page* 735)

Working Details for Building the Brig "Truxton"



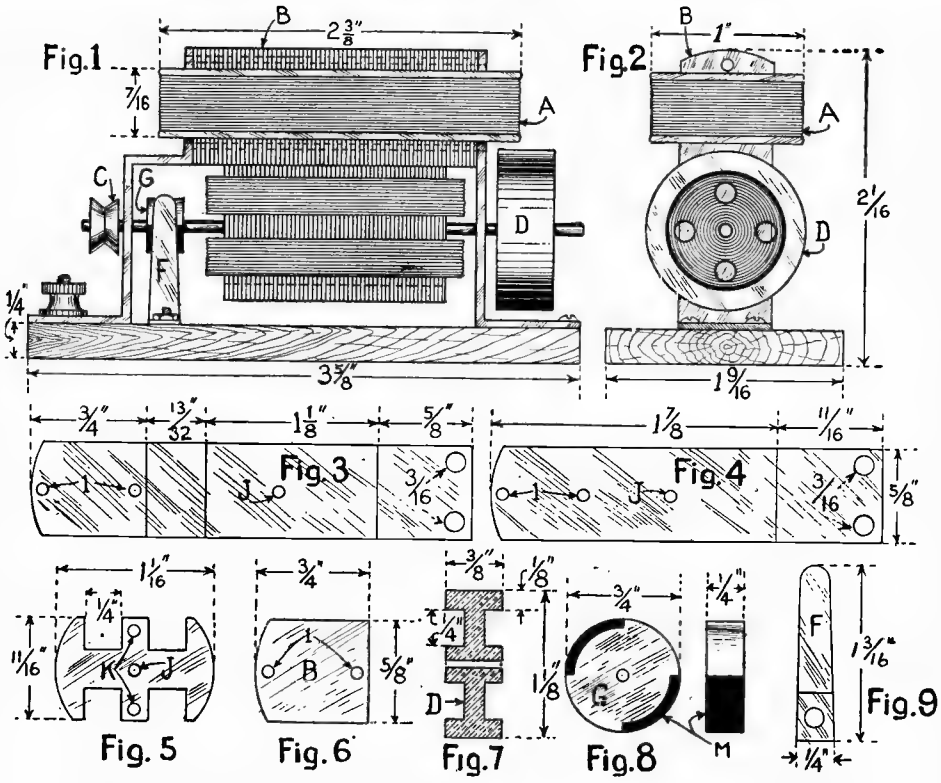
Here are the final details for the construction of the U. S. Brig of War "Truxton." The drawings above clearly indicate the correct position of the various halyards and stays. The plan also shows where the cordage terminates at the masts or on the pin rail.

A Handy Battery Motor

By A. LATHAM

IN the following will be found a complete, and easily understood drawing of an electric motor, with full instructions as to its construction in the amateur workshop, and with what few tools that are generally found therein. This motor will be the pride of the builder, and he will find it to be quite powerful on 6 to 12 volts.

In figure 1, is shown a side view of the assembled motor, from which we can grasp the main details of its construction. The base is made of a good grade of hard wood, which measures when finished, 3⅝" long, 1 9/16" wide by ¼" thick, both field and armature cores are laminated, the field cores, shown at *b* fig. 1 and 2 are made from a soft grade of sheet iron and are cut to the dimensions shown in fig. 6. The laminated armature is also made of soft sheet iron, and are cut to the size shown in fig 5. The main shaft upon which the armature rotates, should be made of hard brass wire, about ⅛ inch in diameter, and the bearings or holes *j* in figs. 3, 4, and 5 should be ⅛" in diameter. The flywheel is turned on a lathe from stock brass or copper. The main armature shaft is tinned on flywheel end and the flywheel is held in place by solder. The armature is fastened in the same way, the laminations being held together by a 3/32 inch brass rod run through holes *k* in fig. 5. These rods are riveted when the armature is in place. The field poles are also held together in the same manner through holes *l* in figs. 3, 4, and 6. The outer plates may be countersunk to allow the riveted heads to be finished even with the surface, giving a neat appearance.



Figs. 1 and 2 show side and end views of an electric motor. Figs. 5, 6 and 7 show the lay out of field and rotor cores. Figs. 8 and 9 show the commutator and one of its brushes.

We will now go on to the construction of the commutator. This is turned from hard rubber or compressed paper, and is made as shown in fig. 8. At *g* fig. 8 is shown the end view of commutator; *m* illustrates the commutator contacts which are made of brass and are inserted opposite each other. Each contact (there are two) covers ¼ of the circumference of the commutator. A small screw is put in the commutator and this in turn is soldered to the shaft which holds the commutator in place.

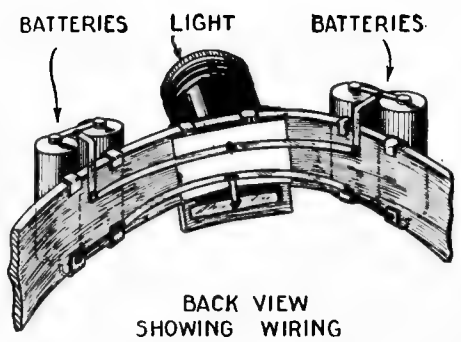
The brush shown in fig. 9 is made from thin sheet brass, there must be two of these.

We will now assemble the armature upon the main shaft after we have all the plates necessary upon the shaft to make up the armature. We will place the rods, above mentioned, through the holes *k* and rivet the armature together. We will now solder the armature in the proper place upon the shaft; next we will mount the commutator in its place, but do not solder this yet. To wind the armature the armature must first be coated with a heavy glue or shellac and each pole insulated with tape or thin paper on the inside. The wire should be 28 gauge B. & S. double silk covered copper wire. Each pole is wound in the opposite direction of the other. Care must be taken that there be no bare places on the wire, to avoid a short in the coils.

Now we will bend motor end plates shown in figs. 3 and 4 so that they will be as in fig. 1, and we can assemble the field pole and fasten it, as we did the armature. Then we can cut from thin sheet compressed paper the top and bottom field coil ends. The winding and insulation will be carried on as with the armature with the exception that we must use number 24 B. & S. gauge wire.

(*Continued on page* 736)

ILLUMINATING HEAD BAND



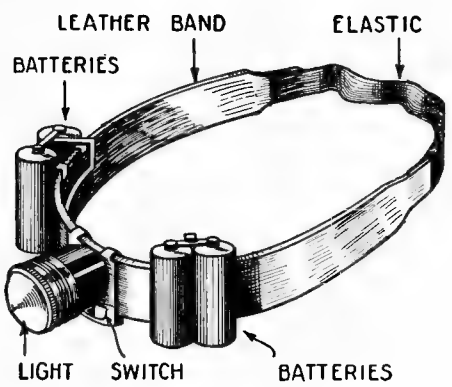
BACK VIEW
SHOWING WIRING

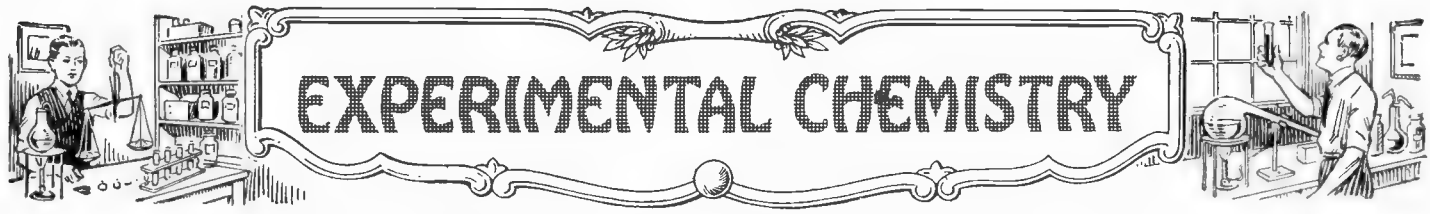
A leather band is held across the forehead and partly around the head by a strong elastic and it carries flashlight batteries and a flashlight, the latter directly in front. On closing a switch, the batteries are thrown into action and the flashlight emits a beam of light. Another touch of the switch, and the light goes out. The feature of the arrangement is that it leaves the hands free, and the beam, which is approximately a parallel one, can be directed any way desired, within limits, by moving the head about.

For some purposes such an appliance would be very useful and convenient.

On the left is a view of the back or interior of a head band carrying flashlight and battery.

On the right the entire appliance is shown; there are four flashlight cells, a pair on each side of the lamp.

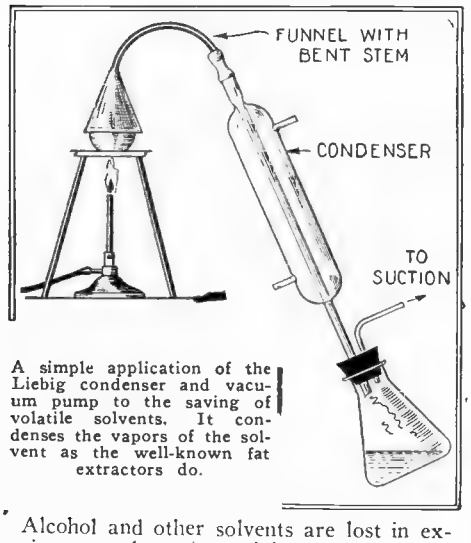




Four Useful Pieces of Chemical Apparatus

Home-Made Laboratory Accessories Dealing with the Use of Liquids and Solvents

APPARATUS FOR THE RECOVERY OF SOLVENTS



A simple application of the Liebig condenser and vacuum pump to the saving of volatile solvents. It condenses the vapors of the solvent as the well-known fat extractors do.

Alcohol and other solvents are lost in experiments when determining solubility by evaporation, when various solvents are used in the laboratory by heating, evaporating the solvents to obtain the solute. The above diagram shows a method of recovering both the solvent and the solute with a minimum loss.

I have found this apparatus, which can easily be assembled from ordinary laboratory apparatus, very efficient. The suction at the receiver not only speeds up the vaporization but also conveys the vapors through the condenser.—*Contributed by E. B. Smith.*

WATER SUPPLY BOTTLE FOR THE LABORATORY

A variation on the chemist's wash bottle for the supply of distilled water, or of other liquids for laboratory use, a very convenient arrangement.

An ordinary bottle of good capacity may be fitted up with an inlet tube and an outlet tube, exactly like a wash bottle, one tube being short and the other reaching pretty well to the bottom of the bottle, as shown.

It is to be used like a wash bottle. If some water is wanted to be introduced into a beaker or test tube, blowing into the inlet tube will cause the water to flow from the jet, and the escape will cease instantly when the mouth is removed from the inlet tube. This is excellent for the supply of distilled water, as it protects it from contamination by dust or fumes.

MAKING BENGAL LIGHTS

Bengal lights, of course, are those firework mixtures which, when ignited, burn with an intensely brilliant white light. They are easily made with little apparatus needed.

Take 16 parts of saltpetre, and mix it with 6 parts of sulphur. To this powder add with frequent stirring 1 part of antimony sulphide. Finally, add 1 part of finely powdered charcoal, and then place in tins for further use.

In order to make the Bengal lights, take a few pieces of thin cardboard, and roll them up into small cones. Stick the overlapping sides of the cones, then cut out discs of cardboard, which shouuld be glued in place in the bottom of the cones.

After this pack the cones (not too tightly) with the mixtures, and finally gum a small piece of waxed paper over the top of each cone.

In order to ignite the cones, all you have to do is to stick a match through the waxed paper, and apply a light to it. The match will burn and it will not be long before it ignites the powder.

IMPROVED WATER BOTTLE

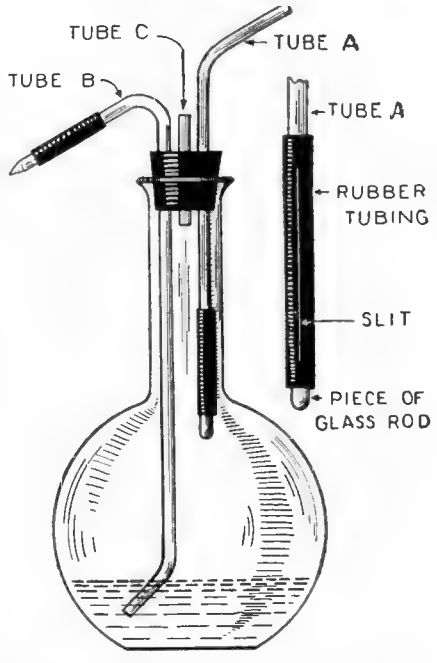
By R. L. GARNER

This water bottle is based upon the use of a simple check valve which has been known to the chemist for many years. It is shown on the right of the cut. A piece of rubber tubing is thrust upon a glass tube, leaving about an inch and a half free. In the lower end of the rubber tube a piece of glass rod with rounded ends is inserted, so as to close it perfectly. With a razor blade a longitudinal cut is made in the rubber, which cut may be about an inch long. If you blow through the tube the air will go out through the slit in the rubber. But if you try to suck air through the tube, the slit in the rubber will close and a perfect check valve action will be produced. The illustration shows how this is applied to the wash bottle.

A cork with three holes is used to fit the bottle, and to the center hole a tube of glass, of course with rounded ends, is fitted.

The bottle is given its proper contents of water and the cork with the three tubes, as shown, is inserted. On blowing into it the air escapes through the tube, C. If the finger be placed upon the top of the tube, C, water will be driven out through the tube, B, in the regular way of a wash bottle. The mouth can now be taken away and the water will continue to flow for a little while, but its flow can be arrested at any time by removing the finger from the tube, C.

This valve, simple as it is, works excellently and has been quite extensively used by chemists.



A wash bottle which will deliver a stream of water as long as the finger is held upon the central tube C, provided enough air has been blown into it. On removing the finger, the flow instantly ceases.

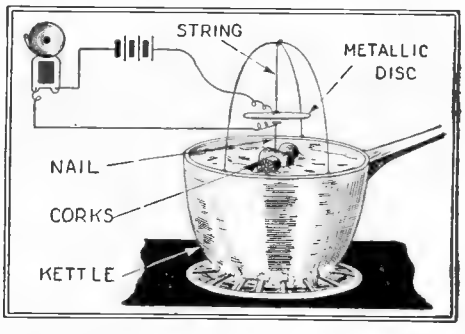
BOILING ALARM

By CLAUDE ROUSSEAN

A wire frame is made somewhat like a tripod, the lower ends of whose legs are bent or shaped so as to fit nicely on the edge of the vessel, beaker or casserole, as the case may be. To the top of the tripod a metal plate is attached by a wire hanging therefrom. One terminal of a battery and bell circuit is soldered to this plate.

A cork float carries a vertical wire and to this the other end of the battery circuit is soldered. This wire may be made adjustable.

The operation is simple and obvious. When the water starts boiling its level rises, the wire carried by the cork float is pushed up against the plate and the bell rings.

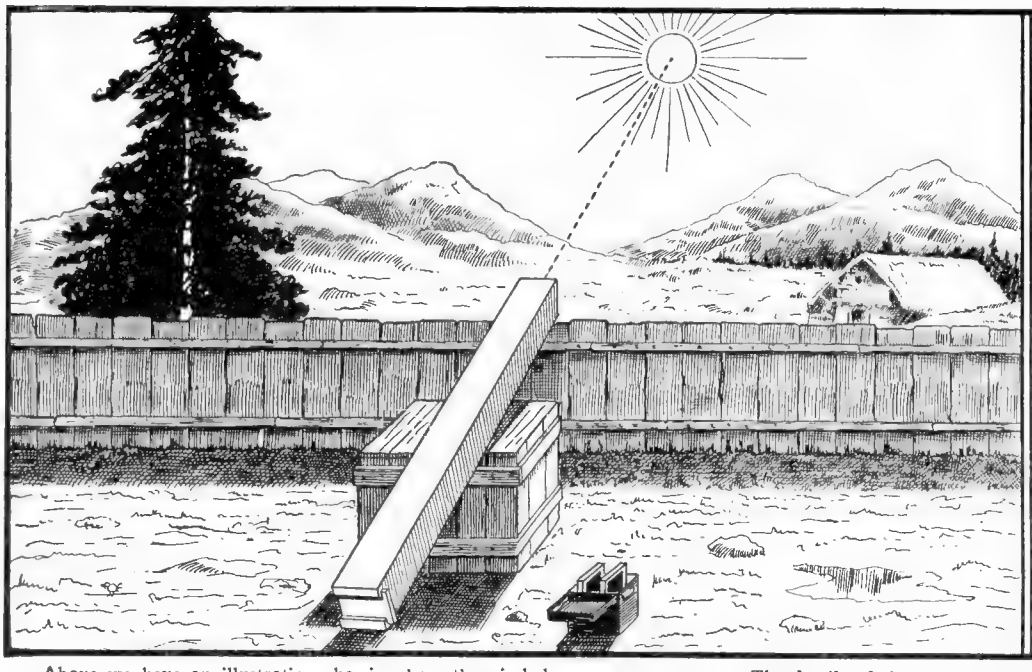


An electric contact is closed when the water in the casserole or beaker boils. This rings a bell notifying the chemist of the fact.

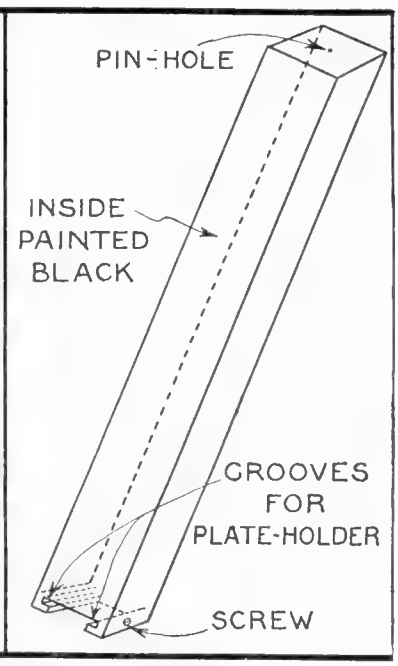
THE CONSTRUCTOR

Articles of Interest to the Home Mechanic

Photographing the Sun without Telescope



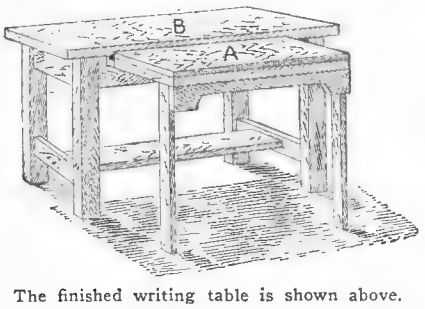
Above we have an illustration showing how the pin-hole camera may be used to photograph the sun without any astronomical equipment.



The details of the camera are shown in the above illustration. This is of the well known pin-hole type with the inside painted black.

A PHOTOGRAPH of the sun may be obtained without any astronomical equipment by using the principle of the pin-hole camera. First build an oblong box as illustrated, the actual dimensions are of little consequence. The inside of this tube is painted black and grooves are provided at one end for the insertion of the plate holder which is held in place by a screw. A hole is bored in the other end of the box and covered with a piece of tinfoil. A fine hole is then made in the exact center of the foil with a needle or a pin. The exact size of this is best determined by experiment. Make the hole small at first, and then enlarge it until it gives the effect desired. The instrument is set up as shown in the illustration and a convenient shutter can be made by draping a dark cloth over the top of the tube. Photographs of the stars or moon can also be obtained.—*Donald H. Menzel.*

A Folding Writing Table



The finished writing table is shown above.

A LIBRARY table made with a lower shelf cannot readily be used as a writing or student's table because one cannot sit with the limbs extended under the table top. The folding table shown in the drawings has solved the problem in one home. The table is of very simple construction, and its cost is about $1.50 exclusive of stain and varnish.

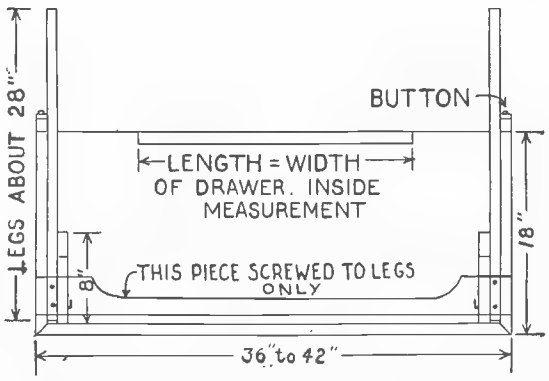
MATERIAL LIST

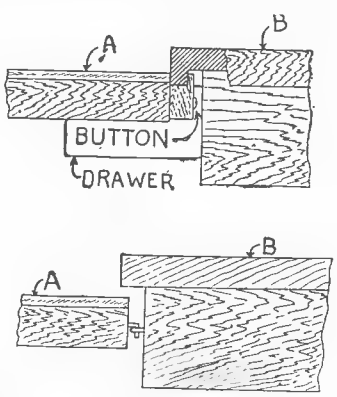
One piece of veneer wall board (may be of Oregon pine), 18"x36" or 42", ⅜" stock.

One piece 1"x1¾"x16' for reinforcing the top, for legs, etc.

One piece 1"x6"x4' for the side rail.

Two 2" right-angle screw-hooks to serve as hinges for the folding legs.





Constructional dimensions and details of the folding writing table are shown in the above illustration.

From the piece 1"x1¾" material, cut three pieces of the proper length and glue them to the under side of the table top along the ends and front edge. Clamps will be needed for doing this work.

Ascertain the distance between the sides (inner measure), of the drawer in the Library table, and cut another piece of the 1"x1¾" material equal to this measurement. Glue this piece to the under side of the table

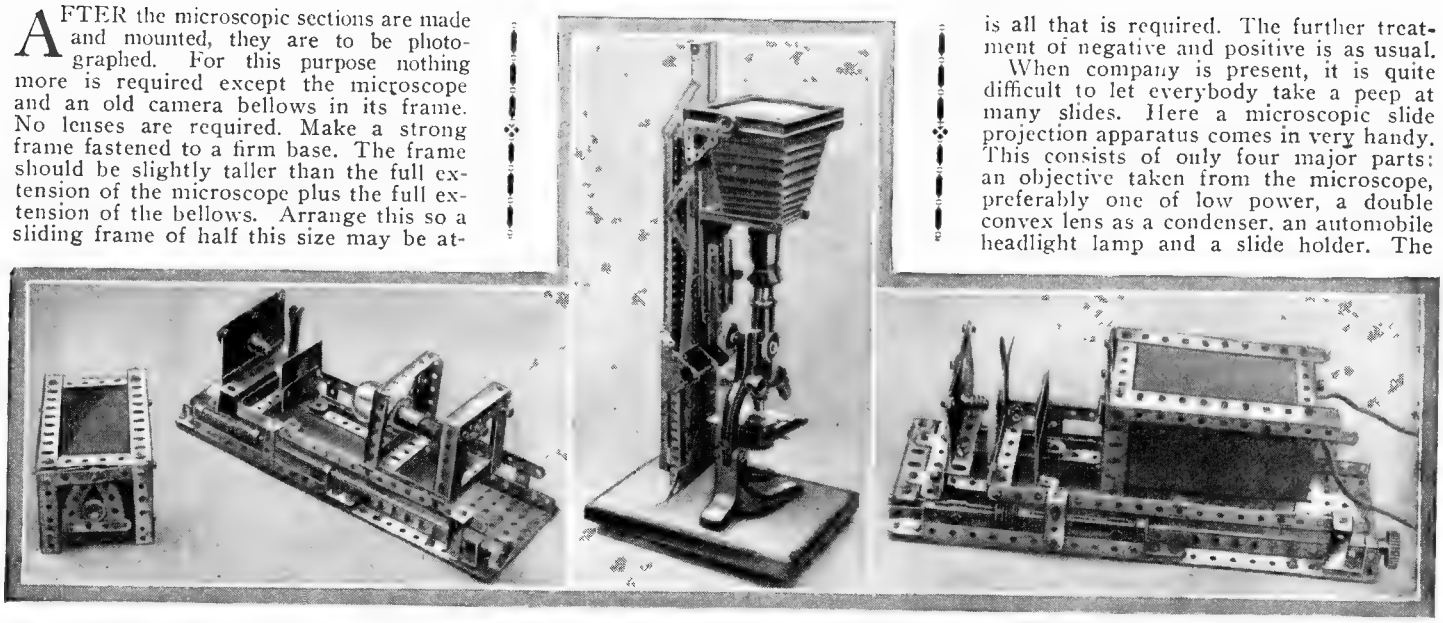
(*Continued on page* 734)

Microscopical Instruments from Toy Constructor Parts

AFTER the microscopic sections are made and mounted, they are to be photographed. For this purpose nothing more is required except the microscope and an old camera bellows in its frame. No lenses are required. Make a strong frame fastened to a firm base. The frame should be slightly taller than the full extension of the microscope plus the full extension of the bellows. Arrange this so a sliding frame of half this size may be attached to it. This smaller frame carries the bellows and lifts it to any desired height by means of a small pinion and a long rack strip. The lower part of the bellows is also movable so that it must be provided with a rack and pinion for adjusting the extension of the bellows. In order to take pictures, select the part to be taken by visual examination, bring the microscope under the microphotographic camera, place a ground glass in the upper part of the plate holder, and focus the object. Remove the ground glass, insert the plate holder, open the shutter and expose. That is all that is required. The further treatment of negative and positive is as usual.

When company is present, it is quite difficult to let everybody take a peep at many slides. Here a microscopic slide projection apparatus comes in very handy. This consists of only four major parts: an objective taken from the microscope, preferably one of low power, a double convex lens as a condenser, an automobile headlight lamp and a slide holder. The arrangement of parts can be seen from the photo. The lamp and the condensing lens are mounted together in a frame and covered with cardboard to exclude the light except that coming from the condensing lens. Next is a second condensing

(*Continued on page 755*)



The projection apparatus is shown above.

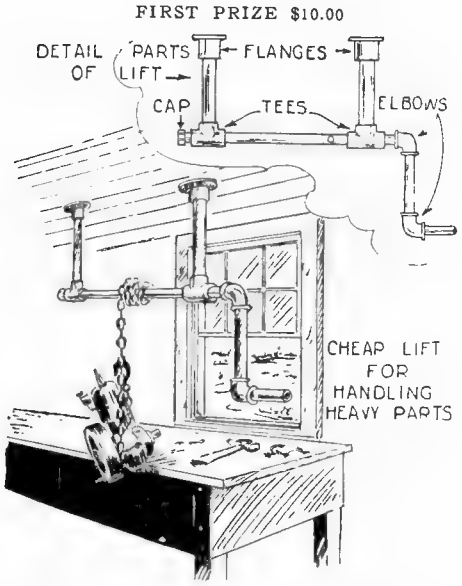
The photo-micrographic apparatus is shown here.

The completed projector may be seen above.

Hints for the Mechanic

LIFTING DEVICE

FIRST PRIZE $10.00



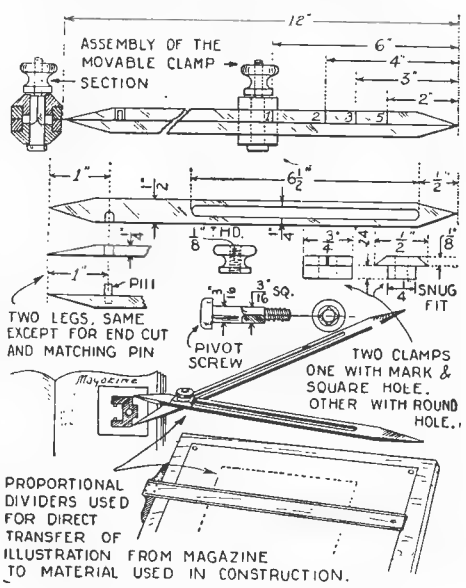
Details of the lifting device are shown here.

THE lifting device shown here can be easily duplicated in any shop and is made from one inch or larger pipe, ordinary floor flanges being used for the overhead support. The pipe tees in which the drum revolves are drilled out and serve as bearings. The drum and attached handle are pinned, in addition to having their connections threaded. The finished lift is placed above the bench and the operator steps on the bench to use it. The lift can be easily duplicated and all that is required are pipe tools for cutting and threading. The cost is negligible when compared to its utility—*G. A. Luers.*

A New Department

BEGINNING with the May number we started this new department—"Hints For the Mechanic," in which we intend to publish wrinkles useful to mechanics in general. You can help us with this department by writing a brief description of your favorite shop wrinkle and sending this to the editor of this department, together with a pencil or pen and ink sketch of the wrinkle. The ideas published herewith will give you some idea of what we want. Our draughtsmen will make the necessary mechanical drawings, so you need not send us finished drawings. We will pay $10.00 each month for the best Wrinkle or Hint sent in; others published will be paid for at space rates. Address all letters to Editor, Hints For the Mechanic Dept., in care of this magazine.

PROPORTIONAL DIVIDER



Details of the simple proportional divider.

In the drawing above, a twelve-inch proportional divider is shown. This tool is used mainly for enlarging or reducing the scale of drawings. The tool is made of two steel rods, forged and filed to provide the center guides for the pivot screw.

—*G. A. Luers.*

(*Continued on page 755*)

HOW TO MAKE IT

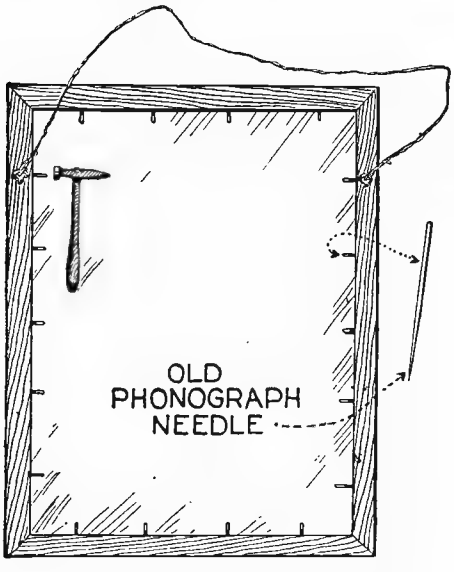
TRICK BANJO

The large banjo accompanies the notes struck on the small one. At the same time, the small lights on the neck of the large banjo show the position of the operator's fingers.

This outfit may be used for banjo playing instruction and may be easily constructed with flashlight bulbs and a multi-wire cable.

USE FOR PHONOGRAPH NEEDLES

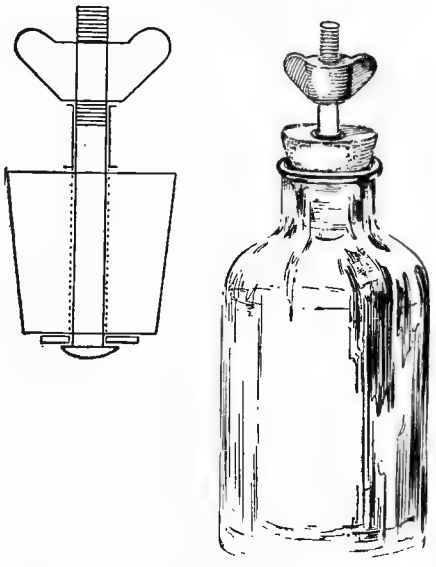
Old phonograph needles may be used to good advantage to hold pictures in their frames. They are considerably better than brads for this purpose because of their rigidity and long tapered point. The long points allow them to be easily driven into even the hardest wood. This may also be done just before putting the putty on a window pane, to hold it in place.



These needles will not split the frame and will prove to be superior to glaziers points.

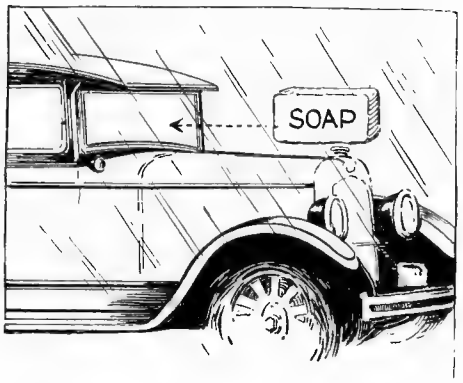
LOCK STOPPER

This type stopper should be used on bottles containing volatile liquids that drive an ordinary cork out of the bottle neck when the weather becomes hot, or when left in too warm a room. The cork is made to grip the bottle neck tightly by expanding it with the wing nut.



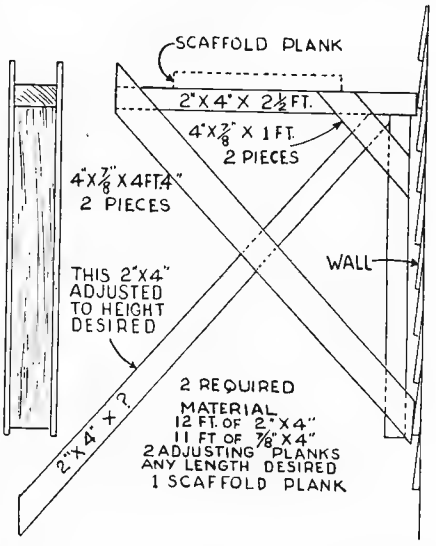
The stem washer is not necessary but is convenient for use when the bottle contains corrosive liquids. The cork and its expanding mechanism should be thoroughly coated with hot paraffine.—D. Menzel.

WINDSHIELD KINK



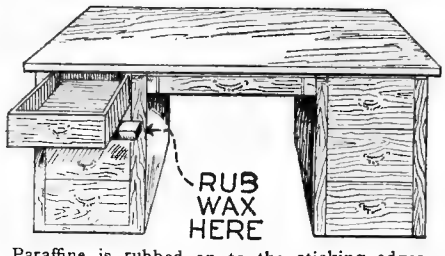
This scheme keeps the windshield clear of raindrops at all times. After the rain starts a cake of soap is rubbed up and down on the windshield. When the rain drops strike the soap film they do not cling to the glass in beads, but form a clear sheet of water. This may be done to all windows in the car, and will provide a clear view to the right and left, thereby making driving in rainy weather safer. The clear glycerine soaps sometimes work better for this purpose. The clear vision through the rear windows will make bad weather driving much pleasanter for those in the rear of the car. This method does away with the wiper which obstructs the driver's vision.—D. M.

VARIABLE HEIGHT SCAFFOLD



This scaffold can be raised or lowered without tools.

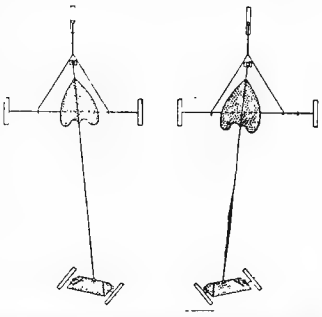
DRAWER LUBRICATING SCHEME

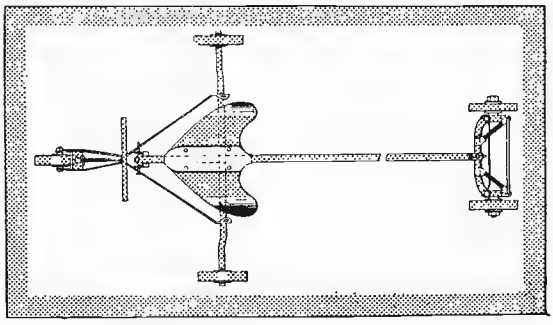


Paraffine is rubbed on to the sticking edges of the drawer.

NOVEL PROPULSION METHOD

This is a push-mobile for children which operates on the roller skating principle. Forward motion is obtained by child throwing his or her weight from side to side.





SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.

FIGHT FAN SUFFERS WIRELESS JOKE

Editor, SCIENCE AND INVENTION:

In the Los Angeles Examiner for September 23, there is a report from Chico, that F. W. Thompson, a realtor, was displaying a red blotch on his right jaw which he said made its first appearance during the seventh round of the Tunney-Dempsey fight. Mr. Thompson claimed that the spot appeared suddenly and immediately after Dempsey sent Tunney to the mat for the count of nine. The explanation was made that it was some sort of a telepathic phenomenon, for it showed up immediately after the blow was announced. What do you think?

C. W. HESS, JR.
Cartago, Calif.

(Not having the report of any investigators who may have seen Mr. Thompson and observed his conduct during the entire fight, it would be impossible for us to comment on the situation. Nevertheless, we doubt very much that any telepathic phenomenon was instrumental in causing the red blotch. —EDITOR.)

TOO MANY PICTURES?

Editor, SCIENCE AND INVENTION:

I am enclosing my own and another subscription. I have subscribed to SCIENCE AND INVENTION for three years, but I will not subscribe to it any longer because it has become a pictorial. Pictures are all right in their place, but they should not be used too much. Your SCIENCE AND INVENTION, I notice, has gradually substituted sketches for reading matter and it has become so that one can digest the magazine in a few hours. A twenty-five cent magazine should furnish enough reading matter to keep one busy for a week or more in spare time. Most of your articles leave the reader "at sea" for lack of complete explanation of the sketches. Take notice of Popular Science. Each photograph is accompanied by a good sensible explanation that is easy to understand. And the subject matter is of things that are on the market, or things that have come into fairly common use. They are not of things which may come into use in future years or generations. There are enough things in common use which are not understood by even the most highly educated scientist, and of which an explanation is welcome. SCIENCE AND INVENTION does not explain these little mysteries and so enlighten the person who observes, but does not always understand. I wish you would make this correction in your otherwise good magazine, and I am sure all of your readers would appreciate it.

CHARLES C. ZIMMERMAN,
Baltimore, Md.

(It was not so long ago that SCIENCE AND INVENTION Magazine was exclusively a pictorial magazine. The editor at that time thought that more knowledge could be gained by a picture than by the written description. Consequently extreme care was taken in making the drawings accurate and detailed. There is an old Chinese proverb which says that a picture is worth ten thousand words. Whether or not this is true depends on the viewpoint of the individual reader and also on his ability to use his imagination in both the formation of the words and in the analysis of the picture.

At the present time, SCIENCE AND INVENTION Magazine is running a "fifty-fifty" publication: that is, approximately half pictures and half text. We do not see how we could better please the general public by maintaining any other form of editorial policy. There are enough photographs and pictures to interest those who like to imagine their ten thousand words. Then there is enough reading matter to interest those desiring written description. At least, that is the viewpoint of the editor and it is up to the readers to either affirm or disagree with this opinion. The editor likewise holds that there is no publication on the American market today which covers as completely the scientific aspect as does SCIENCE AND INVENTION. Not only does it delve into the physical side of science, but also into the meta-physical. Theories are propounded; facts are given; new devices are illustrated, and new advancements are covered completely. This publication is not given to "blowing its own horn," but we will say this much: that of all of the popular scientific publications, the most accurately detailed descriptions on any subject, whether it be Lindbergh's navigation instruments or television, have appeared within the pages of SCIENCE AND INVENTION Magazine.

Do any of our readers deny this statement?—EDITOR.)

HAMILTON AND PERPETUAL MOTION

Editor, SCIENCE AND INVENTION:

In regard to the "Perpetual Motion Hoax" published in your October issue, I certainly lend you my sympathies. It is indeed unfortunate, to say the least, that people are continuously making extremely good use of the technicality and exactness of the law toward their own ends, to the discomforture of others. Since you offered the $5,000.00 in view of proving to those, who evidently cannot think for themselves, that true perpetual motion is absolutely impossible, you were confident that there would never be anyone to win the $5,000.00 by building a successful machine. I would have been just as confident that I could not have lost, if it had been me. The joke really seems to be on you, since being sincere, you expected others to be the same. You did not take into consideration that some of those who might come to claim the offer, composed not only of those who were fooling themselves, but also of those who set out with a deliberate intention of deceiving others and knowing full well themselves that the deception existed. The written contract, enforcible by law, does not take into any consideration the Moral Contract, which though not expressed in words, nevertheless is fully understood by both parties. The moral contract entered into by Mr. Hamilton was expressively that he "actually deliver more output than input," which of course he failed to do. Now there is nothing very baffling about the arrangement of the machine. I cannot see how you or anyone else could be fooled for a moment. I am supposing that you were not fooled, but cleverly tricked in the matter of legal phrasing of the contract. Now for a man of your position it does seem rather humorous, that you could be so tricked legally.

Mr. Hamilton has shown no cleverness in arranging the machine, but a whole lot in arranging the "contract." I admire cleverness a whole lot, but I don't believe it should be used as Mr. Hamilton has done; that of obtaining prize money by deceptive pretenses. Nevertheless, we live and learn, even the best of us. This is certainly a good example to the readers, that one must always take steps to protect one's self legally in such matters, regardless of your confidence in any one. I don't see how he can claim the prize under any conditions. I hope you will not lose confidence in your good work even if you lose the case. I, and I expect we, hope that you will be more careful and clever in the future. Here's wishing you good luck. I'd never part with $5,000.00 myself without making a real fight for it, but I'll never have the $5,000.00 to worry about.

DAVID C. SMITH,
Winston, Mont.

(The purpose of the award of $5,000.00 for a successful perpetual motion machine is two-fold. First, it is aimed to protect investors in perpetual motion machines. Most perpetual motion inventors try to finance an idea, claiming that when they have enough money, they will protect the idea by means of a patent Ordinarily the investor is expected to believe that it will cost thousands of dollars to protect a perpetual motion device by means of patents in these United States and some foreign countries. On the strength of this, they place their money, receiving shares of stock in return. With these beautifully engraved pieces of paper, they can subsequently paper their walls.

If any perpetual motion inventor will demonstrate to us a working model of a perpetual motion machine, we will pay him $5,000.00. With this money he can protect the idea and still have some cash left over for further improvements. Inasmuch as we are asking no rights to the invention, other than that of prior publication, the inventor has nothing to lose.

We frankly do not believe that perpetual motion will ever be invented. The invention of such a device would require the overthrow of the law of conservation of energy, but who cares about such a law. The people of the United States are breaking the law of prohibition daily. This, of course, is easier to overthrow than the one classified as the law of conservation. (We must have our little pun.) We do not believe that this contract which we made with Mr. Hamilton has been lived up to. Had he lived up to the agreement which we arranged, instead of, as we believe, trying to fool us, we would have gladly paid the prize award.

Here's hoping that you will soon have the $5,000.00 to worry about.—EDITOR.)

AMAZING STORIES

IN OUR DECEMBER ISSUE

ROBUR THE CONQUEROR, by Jules Verne. (A Serial in 2 Parts) Part I. Fulfilling the promise to our readers regarding publication of Jules Verne's stories, we shall present, in the next issue, "Robur the Conqueror," a story not as well known as many of the other works of this author. Written long before the invention of the airplane, Verne's picture is that of an excellent aerial machine, a machine that has not even today been fully approached. Excellent science, mixed with fine adventure or travel, makes this story an outstanding one that we know you will like.

THE COUNTRY OF THE BLIND, by H. G. Wells. Here is one of the most unusual stories that you could wish for. As is usual, also, with Mr. H. G. Wells, he again springs a surprise. He takes a more or less innocent subject and manages to make something quite extraordinary out of it. You will like this story.

HICK'S INVENTIONS WITH A KICK (The Hicks Electro-Hydraulic Bank Protector), by Henry Hugh Simmons. Being a true inventive genius, Hicks is undaunted, and he bobs up again with a more marvellous invention than ever. This time it is a contrivance for the absolute protection of banks against any and all robbers.

CRYSTALS OF GROWTH, by Charles H. Rector. Since it is generally agreed growth is a matter of thyroid glands, why might it not be possible, sometime, to systematically stimulate these glands and create a race of giants? The author spins a fascinating tale around this possibility. And other scientifiction stories of excellent merit.

SPIRITUALISM

Editor, SCIENCE AND INVENTION:

Reading of some inquiries in the Forum about Spiritualism and fake work, and the investigations of the editors of SCIENCE AND INVETION prompts me to write.

Being a medium for twenty years, I think I have proved true and false theories, and state here that anyone who says a spirit can lift objects and drop them, such as flowers dropped on the table, and the people present can carry them away, are mistaken. They are wrong. Spirits do bring flowers, but they are spiritual and disappear, and cannot be touched. Neither can they speak independently through trumpets. Of course, we must grant there are times when they give warnings of death, but they are exceptions. These others are false or fakes.

If a person places his hands on the table, the spirits can move the table while the hands are on the table; can lift your load or burden if you lift it also.

My grandmother has been "dead" forty-five years. She told me the other day, in spirit, that if it was possible to move material objects, she would make diamonds and drops of pure gold drip from my finger-tips, and I looked at my hand and I could see diamonds and gold drop from my fingers, they surely looked real and beautiful, but I could not touch them, and they immediately disappeared. 'Tis the way with spirits; can't be otherwise. Here is another that science can't understand. I can tell a person what their distant home looks like, describing objects like furniture, often telling what you will do in the future. Sometimes I have had the honor to see the purity of another's soul, person's soul, and I don't think another person living can do this. I can see the dark spots caused by sin. I have told many people the happenings in their past life of which only they knew. Sometimes they knew that others knew, but that it was impossible that I could know. Here is another that science doesn't know; namely, that there are wave currents. I know no other name for them, that carries, what we call inventions, through the air; so that when a person is quiet, he draws on this current and a new idea appears in his mind, usually when least expected. This explains R. L. Dionne's experiences, and I hope he reads this.

Now I hope this is printed so scientists and professors can criticize the same. I am willing to demonstrate this power.

MRS. MARY TARSIKES,
So. Omaha, Nebraska.

(And we in turn would like to see these demonstrations, if it is possible for you to show the gold or diamonds at the finger-tips, and describe distant scenes.—EDITOR.)

NOT FOOLED

Editor, SCIENCE AND INVENTION:

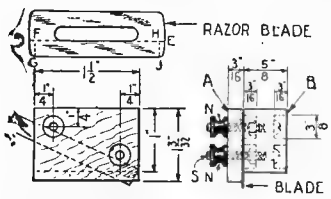
When I read in the September 1927 SCIENCE AND INVENTION the article, "Gravity Nullified," I had my doubts. The statement that quartz crystals under high frequency electrical excitation lost weight, seemed feasible; but the accompanying illustrations and a detailed reading of the article

(*Continued on page* 751)

WRINKLES RECIPES & FORMULAS

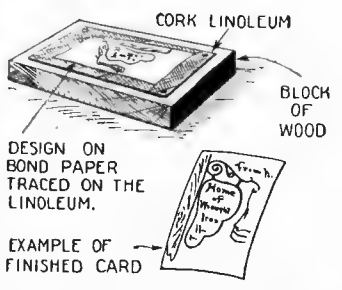
Edited by S. Gernsback

PAPER CUTTER



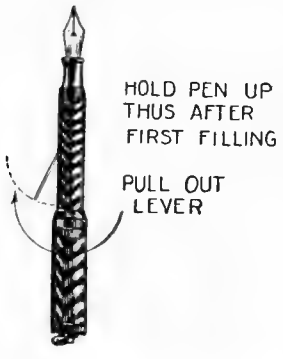
A paper cutter made as shown in the accompanying illustration will be found very useful to draftsmen and students for cutting paper or tracing cloth. There is no danger of marring the straight edge of the T square or ruler. Details are clearly shown in the drawing.—Donald H. Ross.

INEXPENSIVE CUT



Originals of greeting cards, letter-heads and the like may be made by covering a block of wood with cork linoleum. Draw design and letters heavily with black pencil on paper. Tack design face downward and trace on linoleum. Cut away linoleum leaving design and lettering raised. An ordinary ink pad can be used with this inexpensive cut.—E. L. Dunbar.

FOUNTAIN PEN KINK

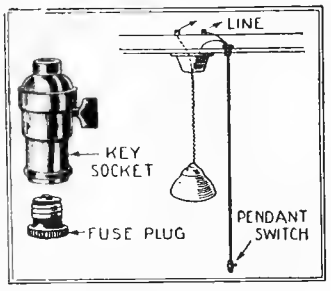


The ordinary fountain pen holds twice as much ink as you think it does. After filling the pen, leave it in the ink a few seconds, hold it upright and slowly pull the lever out again. This will expel all of the air and the pen can then be placed in the ink for a second filling.—Jack Wetzel.

NOVEL DOOR KNOB

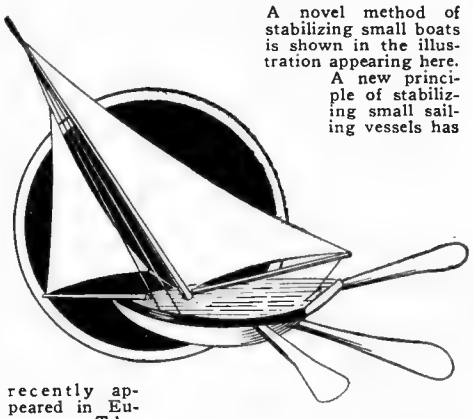
A very unusual door knob is shown above. The key hole is placed where the knob is usually inserted. A lever with a wooden handle is provided in place of the knob giving increased leverage and adding greatly to the appearance of the door.—Die Umschau

SUBSTITUTE SWITCH



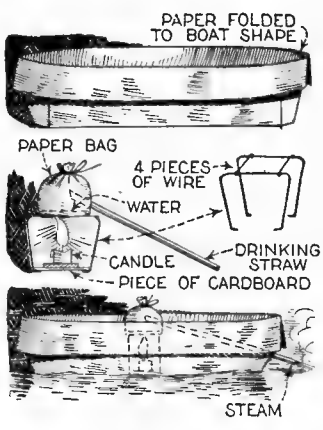
An ordinary key socket will make a good substitute for a pendant switch. Connect the same as any switch as shown in the illustration and screw a fuse plug into the socket. This takes the place of a pendant switch.—Thos. F. Johnson.

BOAT STABILIZER



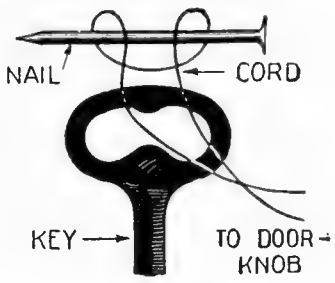
A novel method of stabilizing small boats is shown in the illustration appearing here. A new principle of stabilizing small sailing vessels has recently appeared in Europe. The principle is very simple and consists in increasing the area of support by attaching to the hull a number of small supports. The boat shown in this illustration, shows this principle where the inventor has gained increased stabilization by using two extensions.

PAPER STEAM BOAT



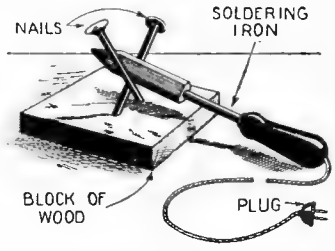
A novel steam boat made entirely of paper can be assembled in a few moments time as shown in the illustration. A piece of paper is folded to any convenient boat shape and four pieces of wire are bent as shown. These support a paper bag filled with water. A candle placed underneath the bag heats the water and produces steam which is led through an ordinary drinking straw which has its outlet under water.—F. C. Jones.

BURGLAR PROOF LOCK



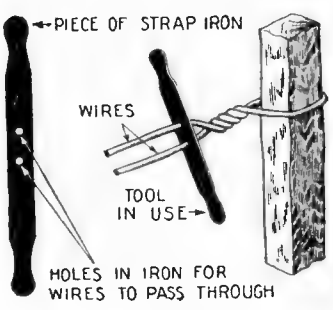
With the aid of an ordinary nail and a piece of cord any lock can be rendered burglar proof. The cord is tied around the door-knob tightly.—E. F. Ziemba.

SOLDERING IRON REST



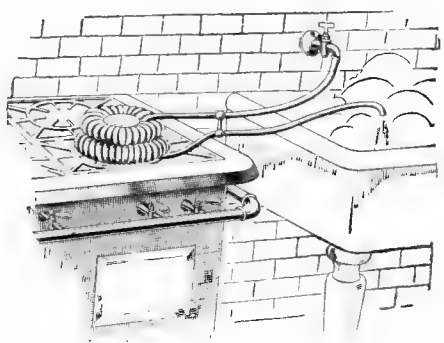
A handy soldering iron holder can be easily made with the aid of two large nails and a block of wood. The two spikes or nails are driven into the wood at an angle as shown in the illustration. Thus, an emergency rest for the soldering iron can be made in a few minutes time, at little or no expense.—John J. Skopal, Jr., Rep. No. 21312.

WIRE TOOL

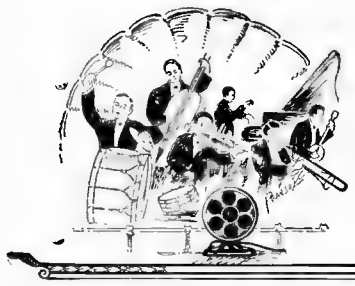


A useful tool for twisting wires can be made from an ordinary piece of iron about a foot in length and an inch wide, as shown in the illustration.—Ivy M. Howard, Rep. No. 19,697.

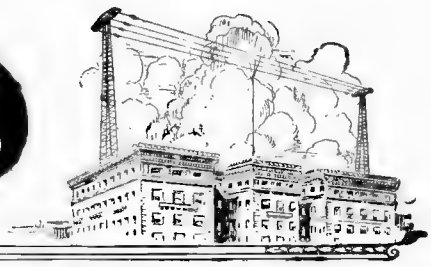
SIMPLE WATER HEATER



A cheap and efficient water heater can be made as shown in the above illustration. It consists of two coils of copper tubing which are placed upon an ordinary gas stove. One end of the tubing is connected to the faucet and the other end is the hot water supply outlet.—La Nature.

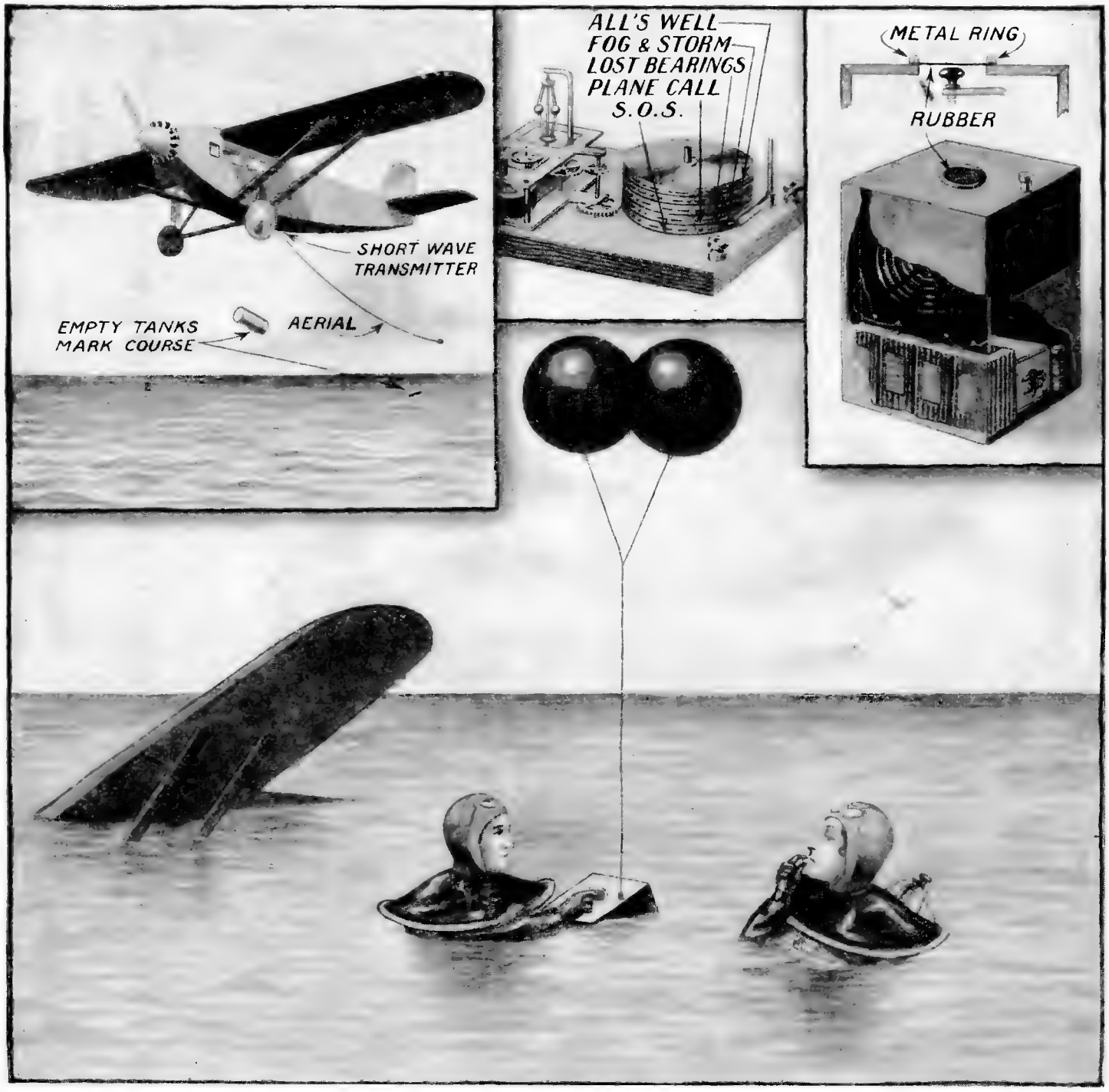


RADIO



Our Part in Ruth Elder's Flight

Science and *Invention* Is Actively Engaged in Safeguarding Transoceanic Flights



Above are illustrated the suggestions which were made to Miss Elder's backers for assuring safety of the trans-oceanic flight piloted by Capt. George Haldeman. At the time of going to press, the aviators had just been picked up by the S.S. Barendrecht, 500 miles from land.

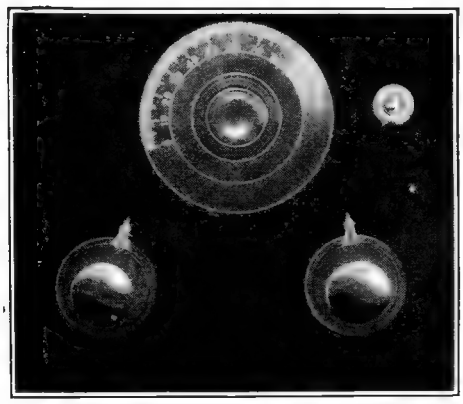
HAS the jinx on trans-oceanic flights finally been broken? Will we be able to fly across the ocean, regardless of the weather as soon as we have perfected the motor, oil supply and ignition to such a point that failure is practically impossible?

The editors of this publication think that trans-oceanic flights need no longer be classed as stunts. Not only do these flights stimulate aviation, but they also establish cordial international relationships.

(*Continued on page* 769)

A One Tube

Simple Set for Traveler

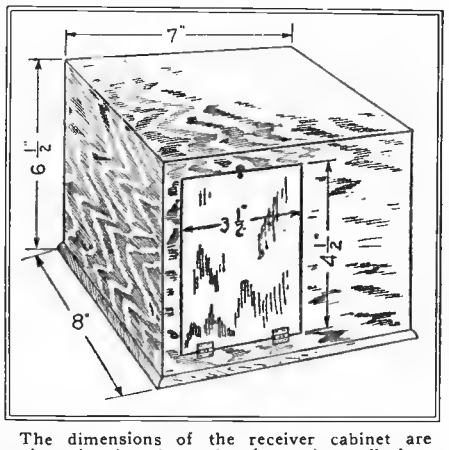


A photograph of the receiver showing the front panel lay-out is given above. Note the symmetrical placement of the tuning controls.

THE amateur constructor or layman likes to keep abreast with the latest developments in radio, and at the present time A. C. tubes are coming to the fore. In the following article is described a simple one tube set using these new A. C. tubes, which set the novice can build with little difficulty at a small initial cost. The set itself is simple, having only one main tuning control, and the circuit is of the well known three-circuit regenerative type. When traveling the set may be easily slipped into the suitcase or trunk, and plugged into the light socket upon arrival at the hotel. Much of the efficiency and selectivity of this receiver is due to the careful construction and correct balance of the primary, secondary and tickler windings of the small three-circuit tuner, which may be seen in the photos. It is advisable to use all parts as recommended; otherwise the set will be too bulky. The completed receiver will fit into a small cabinet, measuring eight inches deep, seven inches wide, and six and one-half inches high. The two B batteries for the plate supply are self-contained within the cabinet itself.

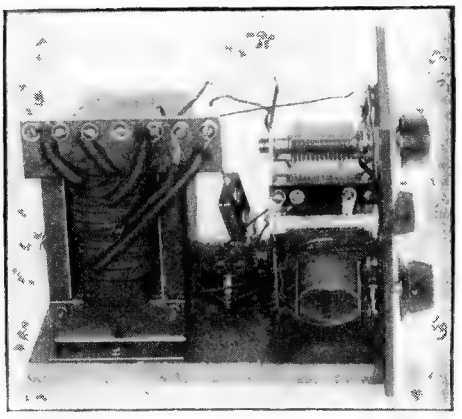
CONSTRUCTING THE RECEIVER

A BASEBOARD measuring slightly less than the cabinet dimensions should be obtained and the parts mounted thereon, as shown in the accompanying photographs. The heater filament transformer, grid leak and condenser, and tube socket, are mounted upon the baseboard, and wired in accordance with the diagram given here. Looking at the set from the front, the filament transformer is mounted on the baseboard in the left hand corner at the rear. The two B batteries are placed next to this. After the parts have been mounted as shown, they should be connected with flexible hook-up wire. The tuning condenser rheostat, jack and small coil, may then be mounted on the front panel, and the panel fastened to the baseboard. The coil is laid on its side and mounted beneath the condenser. The wiring of the receiver may now be completed. As may be seen in the photo, only one binding post is placed on the baseboard in back of the B batteries. This post is for the ground connection. A small hole should be drilled in the back of the cabinet to allow for the insertion of the two A. C. leads. No aerial is used, a .0002 microfarad fixed condenser being placed in series with one of the A. C. leads. However, it might be well to try an outside aerial, and in this case the connection should be broken at the point marked x in the diagram and the aerial connected. The particular type of A. C. tube which was used in this receiver, had the filament terminals situated at the top, and was found to be free from any objectionable hum. If this tube is used, a standard U. X. socket may be employed, and the connection to the positive filament on the socket should be omitted. When using a tube of the *227* type, of course a five prong socket should be used. The connections for this are shown in the accompanying diagram. Due to the fact that the A. C. tubes and transformers themselves are not standard in size, the baseboard dimensions and lay-out may have to be varied slightly, but this should not affect the working of the receiver. In any case, the transformer should be placed as far away from the coil as possible, as an objectionable hum may be introduced into the circuit if this is not done.



The dimensions of the receiver cabinet are given in the above drawing. A small door has been fitted in the back of the cabinet to allow for the insertion of B batteries.

After wiring the set, all connections should be carefully rechecked, and the two A. C. leads should then be plugged into the light socket. If nothing is heard at first, there is no cause for worry, as a number of the A. C. tubes require about thirty seconds before they have become sufficiently heated to operate satisfactorily. The power rheostat may become warm, but this does not affect the operation. If a hum is produced, the center tap of the transformer should be grounded if the transformer has one. It may also be well to try another detector tube. The plug going to the light socket should be reversed, and used in the position which gives the best results. When all conditions are correct, there will be a complete absence of hum. A good ground connection is very important for the proper operation of any receiver, and the receiver described here is no exception.



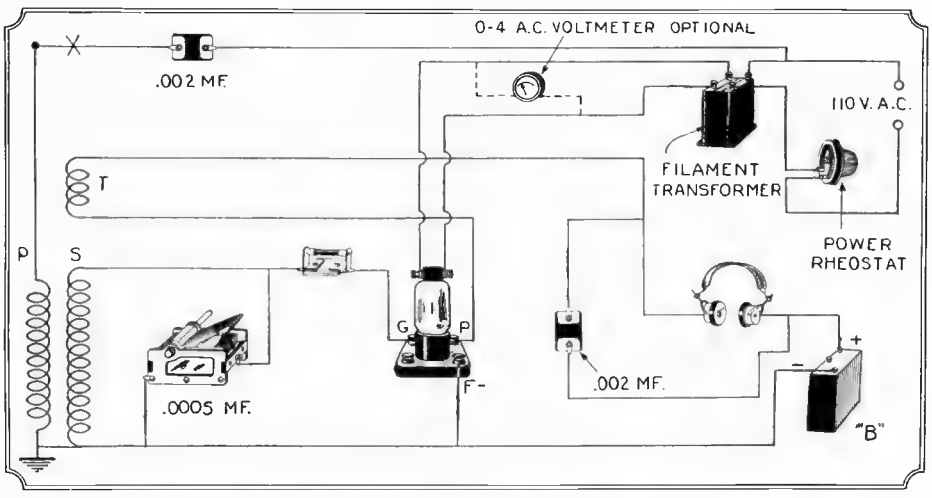
Above is a side view of the receiver with tube removed showing the placement of the transformer, socket, coil and variable condenser.

CABINET SPECIFICATIONS

THE cabinet housing the receiver is small, and measures only eight inches deep, seven inches wide, and six and one half inches high. A small door has been fitted in the back of the cabinet, which allows for the insertion of the B batteries, and should be about four and one half inches high, but three and one half inches wide. The door is hinged at its bottom portion, and is held in place by a small hook at the top.

OPERATION OF THE RECEIVER

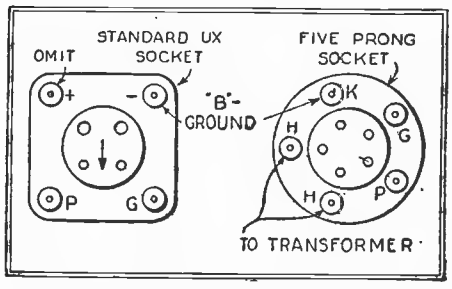
THE receiver itself is simple and flexible in operation, most of the tuning being done with the variable condenser. Regeneration is controlled by the small knob on the left hand side of the panel, which regulates the tickler of the three circuit coil. The set will be found to deliver excellent volume for a one tube receiver, and tuning is sharp even in congested districts. Poor, inconsistent reception cannot only be attributed to faulty atmospheric conditions. It may be due to poor B batteries, or to diminishing electron emission of the tube itself. The small fixed condenser which is placed across the phone terminals is not always necessary, but sometimes is needed to bring



The picture diagram of the receiver showing all of the connections clearly is given above. The A. C. voltmeter shown across the terminals of the transformer, is not necessary, and is entirely optional with the builder. The current delivered to the filament of the tube is regulated by means of a power rheostat placed in the A. C. line.

A. C. Receiver

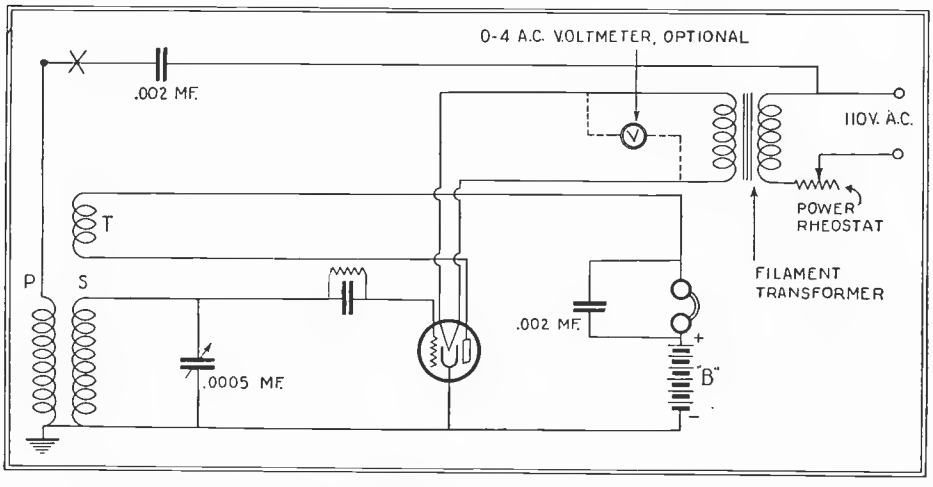
Built at Small Cost



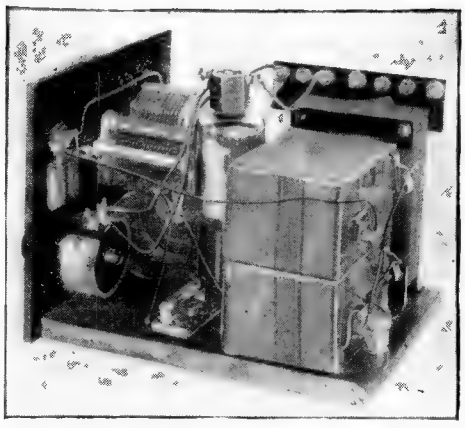
With a four prong vacuum tube of the type used here a standard socket is employed, no connection being made to the positive filament. Connections for five prong socket are shown above.

the receiver into an oscillating condition. The filaments of the tubes should not be operated at a higher voltage than is specified by the manufacurers. It is well to test this out with a voltmeter when the set is first put into operation, and the rheostat when once set can be left in that position.

The set may be operated with an outside aerial if desired. If this is the case, the A. C. line with the condenser in series which is ordinarily used as the antenna should be disconnected at the point marked X on the wiring diagram. The outside aerial should then be connected directly to the primary of the small coupler. For all around purposes, a grid leak of two megohms will prove satisfactory but, volume can sometimes be increased by trying a different value often as high as 5 megohms. This can best be determined by the builder and depends entirely upon the type and characteristics of the tube used. Regeneration is controlled entirely by the tickler of the tuning coil.



The schematic diagram of the A. C. receiver is shown in the above illustration. Note that no outside aerial is used.



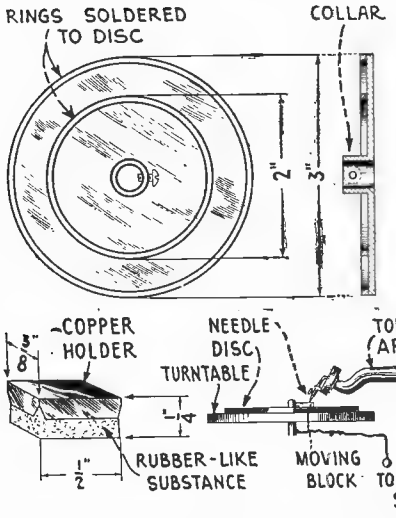
A three-quarter view of the completed receiver is shown above. Note the placement of the phone jack and B batteries.

LIST OF PARTS

1 Bakelite, celoron or hard rubber panel 6½" x 7".
1 Wooden baseboard 6½" x 7¾".
1 Cushion socket.
1 Grid leak and condenser.
2 .002 mf. fixed condensers.
1 .0005 mf. small variable condenser.
1 Small 3 circuit tuner.
1 Power rheostat.
1 A. C. filament transformer for type of tube used.
1 Midget phone jack.
1 Binding post
1 Separable plug.
1 0-4 A. C. voltmeter (Optional).
Necessary hook-up wire, plugs, screws, etc.
Names of manufacturers of parts used in the construction of this receiver may be obtained free upon request.

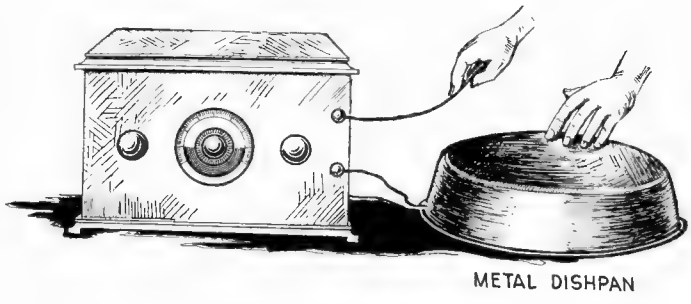
A Dishpan and Phonograph Loud Speaker

By W. O. SPOON



At the right we have an illustration showing how a radio program may be produced through the medium of an ordinary metal dishpan. The fingers must be dry when this stunt is carried out.

At the left we have the details of the disk loud speaker which is used on any phonograph. A metal disk is used fitted with a small collar so that it may be fastened to the turntable post.

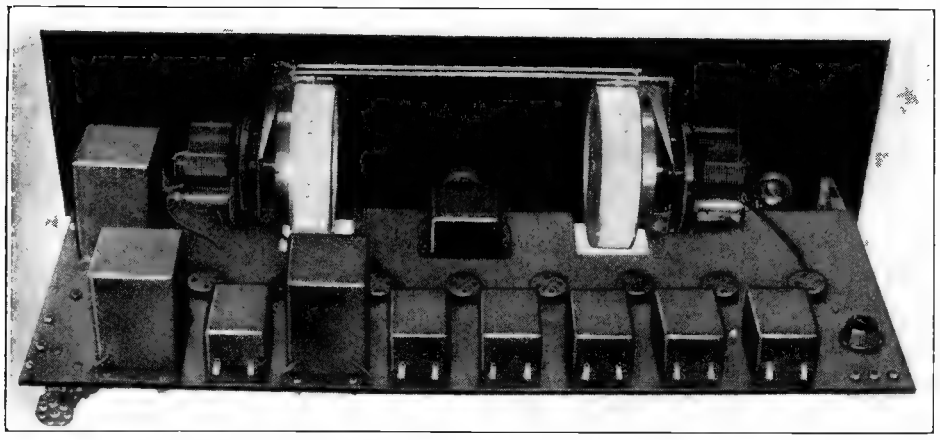


MUSIC may be brought out from an ordinary metal dishpan with a "spooky" effect. One of the output wires of the radio set is fastened directly to the pan, and the other is grasped in the hand. With the other hand rub the tips of the fingers lightly and slowly over the bottom of the pan, and as long as the hand is kept in motion, the radio program will be brought out with good volume. With a little practice music can be brought out with good volume and heard over the entire room. Sometimes by increasing the pressure of the fingers, greater signal strength may be obtained. A shock may be experienced if the fingers are moist.

Using the same principle, music may be reproduced in the same way by using an ordinary phonograph. A small copper or brass disk about three inches in diameter should be fitted with a collar and two rings of bus bar wire as shown. Secure a piece of rubber-like substance and cut it to size to fit within the groove formed by the two metal rings. A copper holder should be made to fit over the top of this rubber. To put this loud speaker into operation, the needle is placed in the reproducer as usual, with the reproducer turned in the position to play the phonograph records. The disk is clamped on the turntable post, and the needle placed in the track on the disk, so that the rubber-like substance will drag in this track as the turntable revolves. Fasten one output wire from the radio set to the crank, and the other to the tone arm, which is connected to the needle. The rubber-like substance may take the form of a soft soap eraser, or the rubber covering which is used on the ink rolls of a printing press. It should be cut to the size as indicated, which is one-half inch long, three eighths inches wide, and one-quarter inch high. The above mentioned novel radio loud speakers work on the principle of electrostatic speakers, which are constructed according to the condenser principle. Loose plates of metal and insulating material, when subjected to a frequency of a few thousand cycles per second, will produce an audible note.

New Nine Tube Loop Set

Four Stages of Intermediate Frequency Outstanding Feature



Note the neat appearance obtained by sub-panel wiring. The use of pin jacks, cable plug connector, and drum type control indicate up-to-date design. All sockets are of the spring suspension type.

THIS "Nine in Line" receiver embodies numerous refinements which have been developed during the many years in which the famous superheterodyne circuit has been in use. This set employs the "super" hook-up in its conventional form, but the design of the individual parts, and the nature of the mechanical layout attract attention because of unusual features.

The receiver shown in these photographs is not a factory built set but was assembled from parts which are available in convenient prepared form. Anybody can make this set at home with ordinary tools, and with the aid of the complete plans and instructions that come with the parts, will be able to turn out a receiver as neat as that shown on this page. This set will be as powerful, selective and reproduce broadcast programs as well as any factory made set.

An unusual feature of this receiver is the use of four stages of intermediate frequency amplification. Two of these are sharply tuned to provide the necessary selectivity. The untuned stages provide extra amplification without making the amplifier so selective as to cause cutting off of the side bands. Another feature which increases sensitivity, is the use of a regenerative detector (1st detector). This regeneration gives as much amplification as one stage of radio frequency amplification.

There is nothing unusual in the frequency changing scheme. The signal energy picked up by the loop is applied to the grid of the first detector, through the oscillator coupling coil. This coil is inductively coupled to the tuned circuit of the oscillator. The regeneration in the detector circuit is secured by means of a center tapped loop and midget variable condenser. The voltage applied to the detector grid is the result of the mixture of the loop energy with the voltage picked up by the oscillator coupling coil. The detector output is the beat frequency modulated by the tube's detector action. The beat frequency is the difference between the two combined frequencies and must match the frequency to which the intermediate stages are tuned. Consequently, when the detector input circuit is tuned by condenser C_1 to the wavelength of a broadcasting station and the oscillator adjusted so that the beat frequency corresponds to the frequency to which the intermediate frequency amplifier is tuned, the second detector receives a modulated carrier frequency. This is detected and amplified in the usual way. The "C" battery detector scheme is used at the second detector to prevent detector overloading.

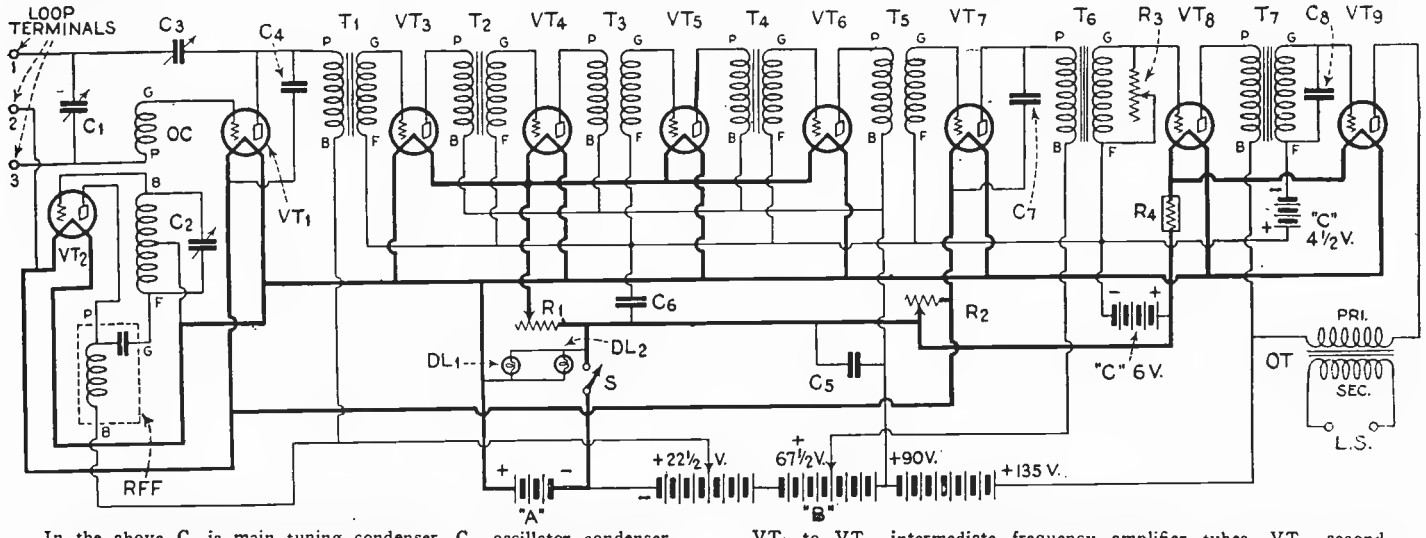
The above tuning scheme sounds complicated but there are only two tuning controls. The dial readings will be nearly the same, just like other two dial receivers. The regeneration control condenser C_3 need only be used when tuning in distant stations. This receiver uses eight O1A type tubes and one 12 type or 71 type in the last stage. The new 12A type tubes may be used even more successfully. The entire receiver in spite of its nine tubes requires less connection wire than many three tube receivers. The grid and plate leads are all short and direct and there is little chance for the constructor to make serious errors.

This receiver has, of course, that unique advantage of all loop receivers with directional loops, the antenna energy having a higher ratio of signal to static strength than non-directional aerial. The directional loop is an efficient collector only in the direction of its plane, consequently, static discharges on either side of its range do not energize the loop.

In spite of the number of tubes, the set does not wear "B" batteries out too fast because the intermediate frequency tubes are negatively biased. The set is easily controlled, due to the use of drum tuning equipment.

The two knobs directly under the drum dials tune the set. The left hand knob is the regeneration control. The lower center knob adjusts the intermediate frequency amplification. The right hand knob is the volume control.

Names of manufacturers of parts for this receiver may be obtained by writing to SCIENCE AND INVENTION. We urge you to be very careful in selecting accessories used in conjunction with this receiver especially the loud speaker. A poor loud speaker will not deliver sounds with frequencies below 200 cycles.



In the above C_1 is main tuning condenser, C_2, oscillator condenser, C_3 regeneration control, VT_1, first detector, VT_2, oscillator, OC, oscillator coupler, RFF, R. F. choke unit, T_1 to T_5, intermediate frequency transformers.

VT_3 to VT_8, intermediate frequency amplifier tubes, VT_7, second detector, T_6, T_7, audio frequency transformers, OT output transformer, DL_1, DL_2, dial lights, R_3, volume control.

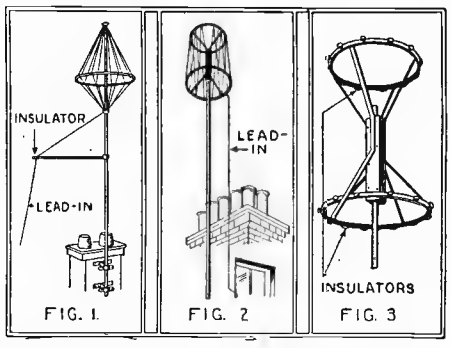
RADIO ORACLE

In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

VERTICAL AERIALS

(591) G. F. Sargent, Seattle, Wash., asks:

Q. 1. Will you please illustrate on your pages some of the simplest types of compact vertical antennas which can be constructed by the amateur and also give some information regarding their construction?



The constructional details of two of the simplest types of vertical aerials are shown in the above illustration.

A. 1. You will find illustrated on this page two types of the above mentioned aerials. Fig. 1 shows one of the simplest forms which is made with the aid of an old bicycle wheel or barrel hoop. The wires are attached to two insulators and lead back and forth with the wooden circle in the center, or nearer the bottom portion. The lead in is taken from one end of the antenna wire as shown. Fig. 2 shows another of these aerials and the form for the construction of this is shown in Fig. 3. In this case two wooden hoops are used with insulators spaced around their circumference to which the wire is attached. These are but two of the simplest types of compact vertical aerials which can be constructed by the amateur, and will give good results with any multi-tube receiver.

DIAPHRAGM VIBRATION

(592) R. A. Rounsavell, Humboldt, Kansas, asks:

Q. 1. Can you tell me how it is possible for a telephone receiver diaphragm to reproduce so many different vibrations simultaneously?

A. 1. In the first place, the diaphragm of a telephone receiver or radio loud speaker is a very imperfect device and in any case, only a partial vibration is produced when more than one frequency is impressed upon the diaphragm. For example, if two sound waves are picked up by a microphone and the resulting currents of say 500 to 1,000 cycles frequency per second are impressed upon the windings of a loud speaker, then manifestly it is impossible for the diaphragm to produce both of these frequencies at the same time. What the diaphragm does do is to make an attempt at the job of performing this dual function, and the result as heard by the ear is really a combination of the two notes; that is, the diaphragm vibrates at a mixed frequency, combining both the 500 and the 1,000 cycle note. You could add as many more frequencies as you cared to the problem in question and the diaphragm will give a resultant frequency or note which will contain a compromise between all of the frequencies impressed upon it. If you have ever studied the compound nature of musical notes, and chords, you will readily understand what happens in the case of a radio telephone receiver or loud speaker when more than one frequency is impressed upon it. Assume for instance, that a band is heard on a loud speaker. At a given moment you hear a certain pleasing chord made up of many different notes known as harmonics by the physicist. Every resultant note in music is made up of many partial notes or harmonics and the fundamental note. This is the one we finally hear. This is the case with the diaphragm as aforementioned; it will strike a happy medium between all of the frequencies impressed upon it and gives you the resultant note.

The diaphragm produces a wave form that conforms to the general contour of the high frequency amplitudes received. This is termed the modulation of the carrier wave, and it should be noted that it is achieved by a mechanical and not by an electrical process. The receiver or speaker unit is one of the most delicate instruments of the whole radio set and it should not be handled freely or abused. A study of its construction brings one to realize that it should always be most carefully handled and protected against jars and shocks of all kinds, no matter how slight. Shocks are the greatest enemies of permanent magnets and nothing will cause them to lose their magnetic properties faster.

ELIMINATING DISTORTION

(593) W. B. Schneider, Burbank, Calif., writes:

Q. 1. I am troubled in my radio receiver with distortion and would appreciate it if you could give me some hints as to its cause and remedy.

A. 1. Distortion is generally due to some trouble in the audio frequency circuits and may be caused by a defective tube, a defective battery, a defective loud speaker, a broken down by-pass condenser which is connected across the loud speaker terminals, or it may be caused by overloading the vacuum tubes themselves. A vacuum tube of the soft or gassy type may cause distortion if used in the audio frequency stages. A worn out, or otherwise defective "C" battery may be so troublesome as to cause the audio frequency amplifier to produce squealing noises. A "B" battery which is very much reduced in voltage may also cause sound distortion and if the voltage is very low there may be a more or less continual high pitched squealing. Distortion may sometimes be due to poor quality audio frequency transformers, such transformers will give very poor reproduction on the high and low musical tones. When the vacuum tubes used for audio frequency amplification are overloaded, there will be a blasting of loud tones. The obvious remedy for this is to reduce the amount of volume which the receiving set is delivering to the audio amplifier. A volume control consisting of a high resistance should be placed across the secondary of the last audio frequency transformer. It is quite possible with the multi-tube sets used today, when installed near high powered broadcasting stations, to impress on the grid of the last tube sufficient voltage to swing the grid voltage beyond the limits of the straight line portion of the characteristic curve. Increasing the "C" battery negative potential, or the plate voltage on the amplifier tubes will tend to reduce this blasting but this is not recommended as good practice because of the possibility of increasing the grid potential to such a point as to cause distortion when the tube is operating with normal volume. Some amplifiers use a fixed condenser connected across the loud speaker terminals. This condenser is known as a by-pass condenser and in this part of the circuit may be subjected to considerable peak voltages. Should this condenser fail a distorted signal will result.

TROPICAL RECEPTION

(594) E. F. Hilder, Phila., Pa., writes:

Q. 1. I intend to construct a receiver for use in the West Indies, but I am undecided as to which type would prove most suitable under the prevailing conditions.

A. 1. The conditions with which you will have to contend would discount any of the multi-tube receivers designed for the reception of the medium or long-wave broadcasting stations and we think it would be advisable to concentrate on the reception of those stations transmitting on very short waves. A number of American and European stations regularly transmit their programs on wavelengths of 20 to 100 meters and these short-waves are more easily received over considerable distances than the others. In addition to this the "atmospherics" are less troublesome on 30 meters than on 300 meters, with the result that the ratio of signal strength to interference is better. Full constructional details of a short-wave receiver suitable for use under the conditions you will find in the West Indies, have appeared in *Radio News Magazine* recently.

RADIO BEACON STATION

(595) S. M. Morford, Brooklyn, New York, writes:

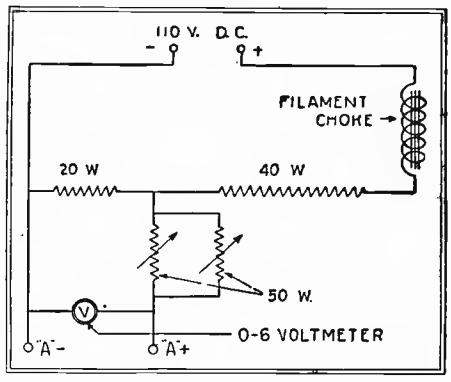
Q. 1. I recently received a rather strange code signal over my experimental radio receiver, which consisted of a group of four dashes with a silent period between each group. Can you tell me what this station was and something of its schedule?

A. 1. According to the information which we have available, it seems that you have received a signal from the radio beacon station of the Nantucket Shoals Light ship, Massachusetts, situated at a latitude of 40 degrees, 37 minutes North, and a longitude of 69 degrees, 37 minutes West. The call letters are WWAH and the signal consists of a group of four dashes, transmitted over a 60 second period with a silent period of 120 seconds intervening between each 60 second period. The station transmits for the second 15 minutes of each hour in clear weather. A radio operator stands watch for the first 15 minutes of each hour from 8 A.M. to 10:15 P.M. in clear weather, and from 10:00 to 10:15 A.M. and from 4:00 to 4:15 P.M. in thick or foggy weather, at which intervals the radio beacon is not used. The operator stands watch on a frequency of 500 kilocycles or 600 meters at the periods stated. The radio beacons are operated on a frequency of 300 kilocycles or 1000 meters continuously during thick or foggy weather. The time is given as local standard time.

D.C. FILAMENT SUPPLY

(596) T. D. Sanstag, Fairland, Okla., asks:

Q. 1. I live in a district where the house lighting supply is direct current and would be glad if you could give me the necessary information showing how I may utilize this to operate the filaments of my radio tubes.



The hook-up for the D.C. "A" eliminator is shown in the above drawing.

A. 1. Those having direct current house lighting supply will find it quite an easy task to construct and put into operation a D.C. "A" eliminator. On this page you will find a diagram designed for the hook-up of such a device. The parts used are as follows:

1—filament choke coil
1—40 ohm 2 ampere resistor
1—20 ohm 1 ampere resistor
2—50 ohm ¼ ampere rheostats.

The choke and resistors should be connected in series across the D.C. supply line going from the positive to one end of the choke, and from the other end of the choke to one end of the 40 ohm resistor, from the other end of this resistor to one end of the 20 ohm resistor, and from the other end of this unit to the negative side of the D.C. supply line. The negative lead for the "A" battery supply is taken directly from the negative terminal of the D.C. supply line. The positive "A" battery lead is taken from the connection point between the 40 and 20 ohm resistors and is connected through the 50 ohm rheostats (the latter connected in parallel), to the positive binding posts on the receiver. A 0-6 voltmeter should be connected across the filament terminals of the receiver tubes, and the two 50 ohm rheostats varied until a potential of 5.0 volts is maintained across them. These two rheostats are connected in parallel to increase their current carrying capacity, and their effective resistance can be varied between the limits of 0 and 25. ohms, which will allow for plenty of voltage regulation, under varying load conditions.

EXTENDING THE SPEAKER

(597) O. Rochelle, Riverside, Ill., asks:

Q. 1. I have a radio set and my friend who lives 1¼ miles away would like to use the same receiver. Would it be possible to run a line from my radio set along the telephone posts to his home?

A. 1. It would be possible to erect a line between the two places. Only one line would be necessary, the earth being the second connection at both ends. Wire used should be of a heavy gauge rubber covered and should be suspended by means of insulators wherever held in position. An output transformer having a ratio of one to one should be used at your friend's home and a two stage amplifier will be necessary with your radio receiver. The amplifier is to bring the drop in the signal strength along the line back to normal. This combination will be entirely possible and good results will be obtained if a power amplifier or power pack is employed.

COMPRESSED AIR CONDENSERS

(598) J. Swoope, Albermarle, Tenn., asks:

Q. 1. Can you tell me if there is such a thing as a compressed air condenser and something of its construction?

A. 1. The dielectric strength of air is very considerably affected by the pressure to which it is subjected. The dielectric constant is not much altered by change in pressure, but the corona loss is considerably reduced at the higher pressures. The usual form of compressed air condenser consists of circular disks of metal alternately connected to the two terminals of the condenser. The whole condenser is contained in a steel tank and a pressure of 200 to 300 lbs. per square inch is applied to the air inside

Scientific Humor

HERE'S HOW

"Johnny," reprehended mother, "don't eat so much or you will have bad dreams."

"That's what I want to do—it's our English lesson for tomorrow."

—*Mrs. L. D. Kerns.*

GIVING HER A TREAT

CHUCK: "Have you tested this liquor to see if there's any poison in it?"

WALLY: "Yes, I gave my wife a drink of it."—*John H. Spicer.*

BOTH STUPID

PROF.: "What are the symbols for carbon dioxide?"

BRIGHT STUDENT: "Is it CO_4, Professor?"

PROF.: "Don't ask me, I'm asking you."

BRIGHT STUDENT: "Well, I don't know either."—*Jay E. Zack.*

BRAIN-FOOT

HER: "You were drunk again last night and you slept with your feet on the pillow."

HIM: "Now I understand why I thought my head was aching. It was only my corns."

—*Henry A. Courtney.*

DIDN'T SATISFY

An old darky was sent to the hospital and one of the nurses put a thermometer in his mouth to take his temperature. Presently, when the doctor made his rounds, he asked:

"Well Mose, have you had any nourishment?"

"A lady done gimme a piece of glass to suck, boss," said the dark patient, "but I's still powerful hungry."—*Fritz Allikas.*

OUT-THINKING THE FORTUNE-TELLER

A prophet went to a man who wanted to know his future; he predicted and asked for his fees.

"You have played me false," said the man, "for you don't know that I am not going to pay you a cent!"—*S. V. Chafekar.*

First Prize $3.00

THE REASON WHY

"So, that air-mail pilot is a high flyer off the job as well as on?"

"Yeah, he has the buttons on his pants sewed on with aerial wire."

—*Henry A. Courtney.*

SKIRTS

Skirts,—once a common noun, has become a mere abbreviation.—*Joseph Wallace.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners, Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

THE WIDE OPEN SPACE

"That luminous paint is a great invention!"

"What do you use it for?"

"We paint baby's face with it so we can give him a drink in the night without turning on the light!"—*Wm. Lemkin.*

SHE A "PEALED"

DING: "She thinks she's a belle?"

DONG: "I wonder who tolled her?"

—*Henry A. Courtney.*

HALF COSTS

"Why did Sandy have the barber shave only one side of his face?"

"Well, he is going to have his profile taken today."—*Richard Perry.*

SHE KNOWS

PHOTOGRAPHER (while adjusting his camera): "My dear madam!—why are you tying that clothesline around your skirts? I can't take your picture that way!"

SUBJECT: "You can't fool me, young man!—I know that you see me upside down in that camera!"—*Wm. Lemkin.*

NEEDS IT ALL THE TIME

MISTER: "Now I'll tune the radio set for you!"

MISSUS: "What?—A brand new radio, and it needs TUNING already?"

—*Wm. Lemkin.*

EFFICIENCY ENGINEERING

"At my home," said one Japanese to another, "we never open a fan entirely when we wish to fan ourselves. We open just one section at a time so as to make the fan last longer."

"But we do better than that," returned the other Jap. "We open the fan all the way, but we make it last by waving the face over it, instead of moving the fan."

—*Adolph F. Lonk.*

A MENS' CLUB

SON: "What was the Stone Age?"

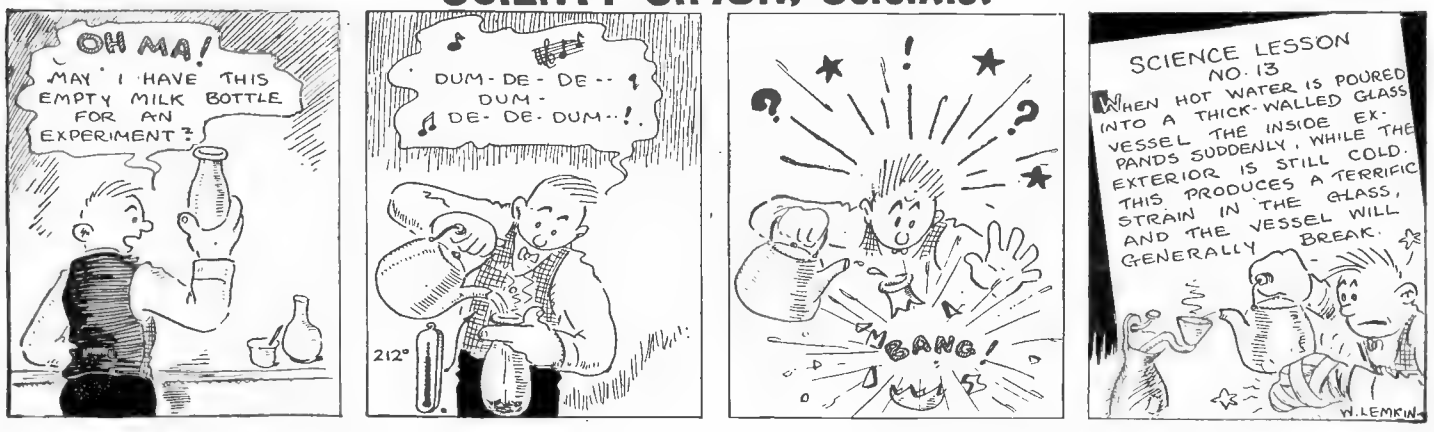
DAD: "That was the period, son, when a man axed a woman to marry him."—*Clifton Ask.*

A LONG-EARED HORSE

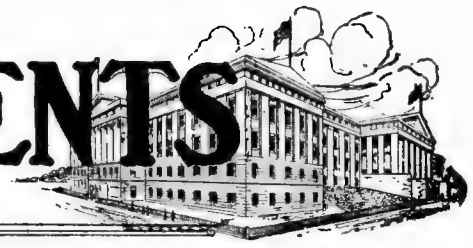
PHYSICS PROFESSOR (after lecture): "Are there any questions?"

STUDE: "Yes, sir. How do you calculate the horsepower of a donkey engine?"—*Clifton Ask.*

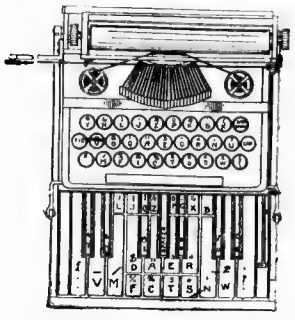
SCIENTY SIMON, Scientist


OH MA!
MAY I HAVE THIS EMPTY MILK BOTTLE FOR AN EXPERIMENT?
DUM-DE-DE--
DUM-
DE-DE-DUM--!
212°
BANG!
SCIENCE LESSON NO. 13
WHEN HOT WATER IS POURED INTO A THICK-WALLED GLASS VESSEL THE INSIDE EXPANDS SUDDENLY, WHILE THE EXTERIOR IS STILL COLD. THIS PRODUCES A TERRIFIC STRAIN IN THE GLASS, AND THE VESSEL WILL GENERALLY BREAK.
W. LEMKIN

LATEST PATENTS

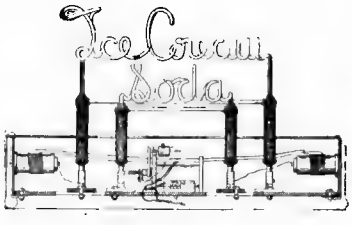


TYPEWRITING KEYBOARD



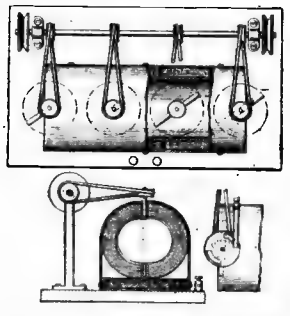
No. 1,598,813 issued to Ewart I. Gale. The invention shown above employs a flat typewriter keyboard similar to the keyboard of the piano. The keys on this new keyboard are all parallel and are separated about the same distance apart as are piano keys. All the parts are of simple construction and compact arrangement so as to assure the highest efficiency and speed of operation.

ADVERTISING DEVICE



No. 1,634,309 issued to Wm. Gentry Shelton. The device shown above is an illuminated advertising sign using neon or Geissler tubes and provides many new improvements. The illuminated portion stands out prominently from the remainder of the apparatus which comprises a high frequency generator placed in a portable cabinet. The invention also provides for an intermittent switch.

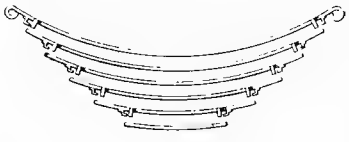
SOLENOID MOTOR



No. 1,635,935 issued to Alexander F. Godefroy. The motor shown above is of the solenoid type and has a number of armatures which interrupt the current thereby producing power which can be used.

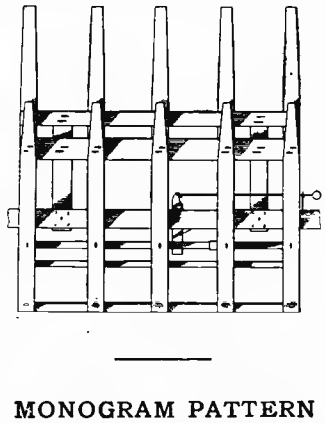
VEHICLE SPRING

No. 1,546,896 issued to William Herbert. The spring shown below consists of a number of successively shorter leaves. Each leaf, except the shortest is fitted with transverse arrangements for engaging and holding the ends of the leaves together. The curves of the leaves are initially formed on the same radius. The object is to improve the construction of leaf springs used especially in automobiles and to minimize the jolting.



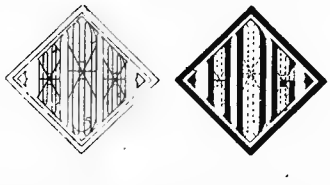
AIRPLANE WING CONSTRUCTION

No. 1,628,940 issued to Jacob Wenger. The figure below shows a plan view of a portion of an airplane wing which has a relatively fixed support but is permitted to vibrate freely. Yieldable carriers are fixed upon the support bar and extend towards the trailing edge of the wing. The leading edge of the wing is unsupported and is thus free to vibrate.

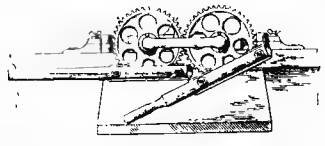


MONOGRAM PATTERN

No. 1,600,229 issued to William A. Heidman. This new pattern for monograms comprises a number of composite letter patterns designed and arranged to conform with the general shape of a single design. Each letter design has portions representing all of the lines necessary to form any letter of the alphabet. The drawing reproduced below shows one of these designs in the form of a pierced plate designed to produce a three letter monogram. All of the composite patterns are joined together by small connecting members and are also joined to the border.

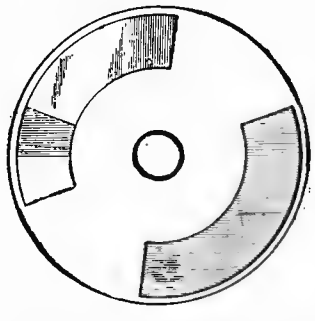


BOW-FACING OAR



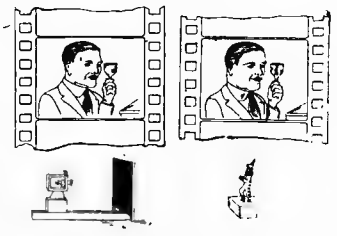
No. 1,634,282 issued to Edward Bechle. The invention shown above is an improvement of propelling mechanisms for rowboats and relates more especially to that type known as bow-facing oars in which the rower faces the direction in which the boat is being propelled for more conveniently directing its course. The oars thus installed may be manipulated as easily and readily as the conventional straight oars ordinarily used. The invention also provides for stowing the oars along the inner side of the boat.

COLOR CINEMATOGRAPHY



No. 1,601,616 issued to Claude H. Friese-Greene. The above disk is a device used in color cinematography and has a pair of apertures through which a negative is exposed, one of the apertures being entirely filled with a red filter and the other with a white filter The disk is rotated preferably at half the speed of an ordinary shutter.

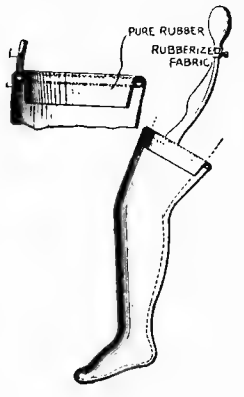
METHOD OF MAKING MOTION-PICTURE FILMS



No. 1,576,854 issued to John F. Seitz. This method of making motion-picture film provides a means whereby a small image can be superimposed upon the regular negative. The process consists in cutting away a portion of the sheet corresponding to a portion of the image to make a first mat, then making a first exposure of a scene while the first mat is in an unchanged position.

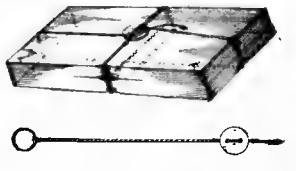
TREATMENT OF VARICOSE VEINS

No. 1,629,108 issued to Simon Lake. The apparatus shown here is used in treating varicose veins and comprises a casing and an elastic band which embraces the body member to be treated. Means are provided for introducing a fluid under pressure into the casing. The pump is capable of being concealed upon the person of the wearer and the pressure may thus be varied at will to suit the individual requirements.



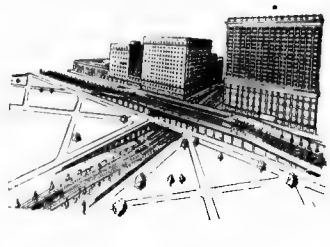
PACKAGE TIE

No. 1,614,690 issued to James S. Pulliam. This tie for packages includes a cord, a combined suspension and anchoring ring on one end of the cord and a disk having a pair of openings therein, through which the ends of the cord extend. The cord is knotted at points adjacent and beyond the disk to restrict the movements thereof. The cord compresses the package and holds the ring firmly in place.



SUPERHIGHWAY

No. 1,628,935 issued to Daniel L. Turner and John P. Hallihan. This invention outlines a superhighway comprising a central railway zone and roadways on each side thereof. Each roadway comprises parallel high speed and low speed lanes at substantially the same grade. Transverse streets leave from the high and low speed lanes.



NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information as it is practically impossible to obtain up-to-date addresses. —EDITOR.

THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

CARBON PAPER

(2218) Mr. D. B. Baskerville, Salem, Virginia, asks:

Q. 1. Please give me a formula for a coating to make carbon paper.

A. 1. Many carbon papers act by virture of a detachable pigment, which, when the pigmented paper is placed between two sheets of white paper, and when the uppermost paper is written on, transfers its pigment to the lower white sheet along lines which correspond to those traced on the upper paper, and therefore gives an exact copy of them on the lower sheet.

The pigments used are fine soot or ivory black, indigo carmine, ultramarine, and Paris blue, or mixtures of them. The pigment is intimately mixed with grain soap, and then rubbed on thin but strong paper with a stiff brush. Fatty oils, such as linseed or castor oil, may be used, but the grain soap is preferable. Graphite is frequently used for black copying paper. It is rubbed into the paper with a cotton pad until a uniform light-gray color results. All superfluous graphite is then carefully brushed off.

PRECIPITATING METALS ON FABRIC

(2219) Mr. Edward Butts, Georgetown, Colo., asks:

Q. 1. Will you kindly list the proper reagents for precipitating metallic copper from its salts upon cloth, also lead from its salts. For example, if I should dye a fabric with a lead acetate or a copper sulphate, is there any way in which I could convert the salt back into the metallic state on the cloth.

A. 1. Your problem of charging a piece of cloth with metallic copper is a peculiar one. If a copper salt such as the sulphate is treated with hypophosphorous acid or with a solution of sodium hypophosphite, copper hydride will be precipitated.

If this is heated to 60° C (140° F.) the hydrogen will be expelled and metallic copper will remain. The copper will be very finely divided.

Saturate your cloth with copper sulphate solution, dry it, immerse in or better, distribute sodium hypophosphite over it with an atomizer and heat to 140° to 150° F. You will then have metallic copper all through it.

This may answer your purpose; it is the best suggestion we can make.

Q. 2. Will you kindly tell me what ingredient to put in gelatin to make it insoluble in water.

A. 2. To make gelatine insoluble use potassium bichromate and expose to sunlight. Formaldehyde will make it insoluble.

SOLDERING ALUMINUM

(2220) Mr. J. B. Holland, Maupin, Oregon, writes:

Q. 1. Can you give me any information in regard to an efficient solder which will effectively and permanently solder aluminum as well as other metals?

A. 1. In actual practice, the soldering of aluminum depends more upon the one who is doing the work than upon the solder used. The chief difficulty lies in the fact that aluminum dissipates the heat so rapidly and oxidizes almost instantly upon exposure to air. The thin film of oxide prevents the formation of a perfect union.

The best process that we know of is to coat the surface with melted solder and keep the solder molten, at the same time scratching the surface below it with a wire brush. This removes the oxide film and allows the aluminum to be tinned. When the parts to be soldered together are well tinned they can be soldered in the usual manner using rosin or zinc chloride as a flux.

An excellent solder for use on aluminum is made as follows:

Tin	10 parts
Cadmium	10 parts
Zinc	10 parts
Lead	1 part

The work should be prepared by dipping it into a solution of nitric acid in three times its bulk of hot water, the solution also containing 5% commercial hydrofluoric acid. Rinse the metal after removing from the acid bath and dry before soldering.

Another method of soldering aluminum in which no flux is to be used is to use the process mentioned above, that is, covering the surface with the melted solder and scraping it. This solder is made up as follows:

Silver	2%
Aluminum Phosphide	9%
Tin	34%
Zinc	50%

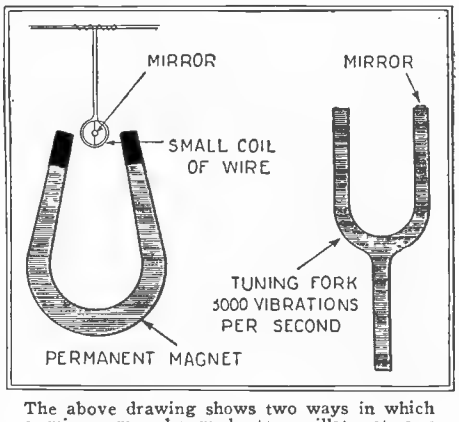
OSCILLATING A MIRROR

(2221) Mr. J. C. Kaytor, Cleveland, Ohio, writes:

Q. 1. Please give detail as to how a mirror 1/16" in diameter could be made to oscillate at a frequency of approximately 3,000 vibrations per second.

A. 1. The answer to your query depends to a very large extent upon the method you desire to employ. If you wish a mechanical method of causing the mirror to oscillate, a tuning fork of the correct frequency could undoubtedly be used.

If electricity is to be used, a method similar to that used in the ordinary oscillograph could be used. This depends upon a small coil of wire suspended between the ends of a permanent magnet. When a current of electricity of a certain frequency passes through the coil, the coil will oscillate in accordance with the frequency. A small mirror attached to the supporting wire or to the coil itself would also oscillate. The current, must have a frequency equal to that desired for the mirror's oscillation.



The above drawing shows two ways in which a mirror may be made to oscillate at any desired frequency.

SOLDERING CAST IRON

(2222) Mr. James Hayek, Chicago, Illinois, inquires:

Q. 1. What is the most practical way of soldering or tinning cast iron?

A. 1. One process consists in decarbonizing the surface of the cast iron to be soldered, the molten hard solder being at the same time brought into contact with the red-hot metallic surfaces. The admission of air, however, should be carefully guarded against. First pickle the surfaces of the pieces to be soldered, as usual, with acid and fasten the two pieces together. The place to be soldered is now covered with a metallic oxide compound and any one of the customary fluxes and heated until red hot. The preparation best suited for this purpose is a paste made by intimately mixing together cuprous oxide and borax. The latter melts in soldering and protects the pickled surfaces as well as the cuprous oxide from oxidation through the action of the air. During the heating the cuprous oxide imparts its oxygen to the carbon contained in the cast iron and burns it out. Metallic copper separates in fine subdivision. Now apply hard solder to the place to be united, which in melting forms an alloy with the separated copper, the alloy combining with the decarburized surfaces of the cast iron.

MOLYBDENITE A PHOTOELECTRIC MATERIAL

(2223) A. Munsey, Auburn, Indiana, writes:

Q. 1. I have recently heard that molybdenite has certain photoelectric properites. Can you tell me whether or not this is so?

A. 1. Acccording to Dr. W. W. Coblentz, of the U. S. Bureau of Standards, a piece of the molybdenite, one of the chief sources of the metal molybdenum, may replace the fragile photoelectric cell in some forms of scientific work. Dr. Coblentz has been studying what he calls the actinoelectric effect of molybdenite, the property that causes it to convert light energy falling on it into electrical energy. Previously he found that pieces of the mineral had closely adjacent spots which generated either positive or negative electricity. The result was that when the whole crystal was exposed to light, the positive and negative excitations neutralized each other and very little effect was noted; but if a single spot was selected and illuminated, a current was produced of sufficient intensity to be indicated by a galvanometer. Recently, however, Dr. Coblentz has found crystals of which all the sensitive spots give the same kind of electricity, either positive or negative. When one of these crystals is completely illuminated, a considerable current, as compared with the others, is produced. By using vacuum tube amplifiers the current may be magnified greatly and the crystal made available as a delicate detector of light. Such a crystal is sensitive to visible light waves and to the infra-red or heat waves.

MANUFACTURE OF RUBBER

(2224) G. B. Moquith, Angora, New York, asks:

Q. 1. Will you kindly give me a brief outline of the process used in the manufacture of rubber?

A. 1. Rubber is produced by several hundred species of plants, mostly natives of the tropics, though hardly more than one-half dozen of these species are of any commercial importance. Rubber is drawn from the plant as a milky latex, which consists of a colloidal solution of rubber dispersed in a watery fluid. The colloidal particles seem to be covered over and stabilized by a coating of other material; but acetic acid or acrid smoke from a wood fire causes the droplets of rubber to coagulate, or gather together in a curdy mass. This product is crude rubber. It is ground and washed with running water to remove impurities, then kneaded with one of the so-called fillers, the best of which are lamp-black and zinc oxide. These, and the kneading process itself, increase the toughness, hardness, and tensile strength of the rubber. Pure rubber is sticky in warm weather and almost as stiff as sheet iron when cold. To overcome these faults, and to enable it to remain pliable over a greater range of temperature, it is blended with sulphur, in a process called vulcanizing. For this, either sulphur is used (hot vulcanizing) or, less commonly, some compound which will slowly liberate sulphur in a finely divided condition. Vulcanization is assumed to consist, at least in part, in a chemical union of sulphur with the unsaturated hydrocarbon molecule; but its exact nature is still unknown. Many substances are known which serve as accelerators of the vulcanizing process; zinc oxide has this property, in addition to serving as a filler. With the best of these accelerators, it is possible to vulcanize rubber at room temperature in a few hours' time. Hard rubber contains up to 30% sulphur.

CARE OF PLATINUM APPARATUS

(2225) O. Santella, Denver, Colo., writes:

Q. 1. I have several platinum crucibles which I use in my laboratory and would be grateful to you if you would give me some general rules for the care of them.

A. 1. Platinum may suffer a slight loss in weight when heated for a long time in a blast lamp, on account of the volatile impurities. It is extremely resistant to individual acids of all kinds, and to aqueous solutions of salts and alkalies. However, it must not be used in the presence of aqua regia, or any substance (such as $FeCl_3$) which yields chlorine on being heated. Fused caustic hydroxides or peroxides, fused alkali sulphides and silicon attack platinum at red heat. Phosphorous, phosphides, or phosphates in the presence of reducing agents, such as the carbon in filter paper, will also injure the metal. Lead, or any other metal that alloys with platinum, destroys a crucible when heated. A smoky flame should not be used, as this appears to form a carbide of platinum, which is decomposed on further heating, leaving the metal crystalline and brittle. Platinum ware should be kept clean and bright. One should use moist beach sand, never sharp sand, for polishing off the crystalline film that sometimes forms on dishes or crucibles that have been heated for a long time at high temperatures. Stains of iron oxide may be removed by heating strongly with a little potassium bisulphate.

BUILD YOUR OWN SHIP MODEL

CONSTITUTION
Size: 30" high; 32" long; 10" wide (overall)

You can build a beautiful Ship Model as low as $4.98 or a Loud-speaker Ship Model for $12.50 with your own hands in a few hours of pleasant pastime from parts, cut to fit and ready to assemble, supplied by the largest builders of ship models in the world.

A fifteen-year-old school boy won first prize in a model building contest with a Constitution model built from our kit of parts. More than 1,000 models were entered in this contest.

LA PINTA
A ship model loud speaker
Size: 26" high; 27" long; 12" wide (overall)

We will supply the parts for the Constitution (Old Ironsides) cut to fit and ready to assemble for $6.98. This price includes every part necessary for constructing the complete model. Full instructions for assembling Old Ironsides are included with each kit. A diagram of parts, showing the number of the parts and just exactly how to piece together the model, make it impossible for you to make a mistake. Other beautiful ship models can be built from our cut to fit and ready to assemble parts. We have kits for the Santa Maria, the La Pinta and the Mayflower at $4.98 each.

This is the most beautiful loud speaker on the market. We will supply you with all parts necessary and complete instructions for building this beautiful loud speaker ship model. The price of $12.50 also includes the melody sail and loud speaker unit. The unit is of the Electro Magnet type and does not require power amplification to bring out the low notes as it gives faithful reproduction at all frequencies. The mainmast is deeply imbedded in the solid wood hull and the unit is attached to this mast, making it impossible for counter-vibrations to affect reproduction.

A USEFUL AND ORNAMENTAL HOME DECORATION

No doubt you have often admired ship models and yearned to possess one but could not do so because the price was too high. Let the WORLD'S LARGEST BUILDERS OF SHIP MODELS AND SHIP MODEL LOUD SPEAKERS supply you with all the necessary parts, cut to fit and ready to assemble from which you can build a beautiful model.

You need not know anything about ship building or carpenter work in order to build one of these ships. No special knowledge of ship model building is necessary either. We will supply all the parts, from the hull down to the smallest piece, all cut to fit and ready to assemble. You cannot go wrong. Diagrams and plans of parts that are included with each kit tell exactly what to do with each part.

These plans show you step by step just how the model is constructed. Everything is made so simple that even a small child can build a beautiful model.

All you need is a small hammer to tap the parts into place. Here is a part of the instructions copied word for word from the diagram and instruction sheet that goes with the kits. "Take part No. 57 place it in front end of part No. 56 and tap lightly with a hammer. Next take part No. 58 and place it up against No. 57 and tap it with a hammer to bring it into place."

Easy! Nothing simpler. The instructions are like that from beginning to end. Do this and that and before you realize it a beautiful ship model has grown before your eyes.

Write for our free, beautifully illustrated catalog, which contains photographs of all our models together with complete details and price of each. We will send this catalog without obligation to you. Fill in the coupon below and we will act upon it immediately.

If, after assembling the model according to our instructions, you do not think it worth many times the purchase price, return it to us in good condition and we will gladly refund your money.

MINIATURE SHIP MODELS, Inc.
3818-20-22-24 Baring St., Philadelphia, Pa.
Canadian Branch: **1485 Bleury St., Montreal, Canada**
Canadian Prices Slgihtly Higher. Send all Canadian Orders to Canadian Office.

MINIATURE SHIP MODELS, Inc., DEPT. S3
3818-20-22-24 Baring St., Phila., Pa.

Please send me complete parts, cut to fit and ready to assemble for the Constitution, $6.98 ☐; Santa Maria, $4.98 ☐; La Pinta, $4.98 ☐; Mayflower, $4.98 ☐. Melody Ships: La Pinta, $12.50 ☐; Santa Maria, $12.50 ☐; Mayflower, $12.50 ☐. I will pay postman purchase price plus postage (a few cents). Check which model you want shipped.

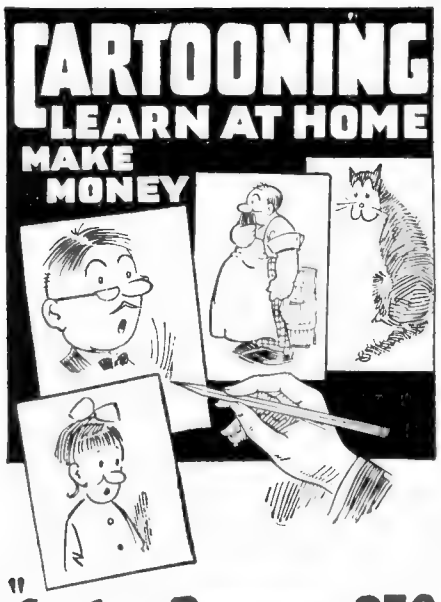
PLEASE PRINT NAME AND ADDRESS PLAINLY.

Name .....

Street or R. F. D. .....

City .....

State .....



"Student Receives $250 For a Few Cartoons"

Just read the following "straight from the shoulder" letter and you'll see why we say that the Washington School of Cartooning can prepare you for the big-pay field of Cartooning, in your spare time, at home, by mail.

"The enclosed cartoons," says O. A. Pokrandt, a Wisconsin student, "are samples of my progress in drawing. I have received $250 for these and the enclosed letter will show that I have a ready market for my work in the future. The making of cartoons has been one round of pleasure and enjoyment as well as profitable to me."

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There's no more attractive or highly paid profession today than Cartooning. Millions of dollars are spent every year on cartoons. Capable cartoonists earn from $50 to $250 a week. Learn to draw side-splitting comics—right at home in spare time through this amazing method that has already been tested and proved by many Washington School Graduates. No special talent or previous training needed. No drudgery. And in a very short time you should be ready to make real money drawing cartoons.

Send for FREE Book

A new handsomely illustrated book has just been printed, which gives all the most up-to-date information on the wonderful opportunities in Cartooning, and shows how this startling method enables you to enter this field. It tells all about our students—their success—what they say—actual reproductions of their work—how they made quick profits while studying. This attractive book will be sent without cost or obligation. Send for it. Mail coupon NOW. (No salesman will call.) WASHINGTON SCHOOL OF CARTOONING, Room 2612-E, 1113-15th St., N. W., Washington, D. C.

Washington School of Cartooning,
Room 2612-E, 1113-15th St., N. W.
Washington, D. C.

Please send me, without obligation, your illustrated FREE BOOKLET on Cartooning and details of Special Offer to New Students.

Name .....
(Write name plainly—state whether Mr., Miss or Mrs.)

Address .....

City..... State.....

Age.....

Motor Hints

Conducted by GEORGE A. LUERS

(Continued from page 712)

are likely to cause damage by attacking the metal parts in the cooling system, as well as the rubber hose connections and gaskets.

The following table of proportions is given for reference in making up anti-freeze solutions.

GLYCERINE

25	percent	10	degrees above zero
35	"	0	"
45	"	20	" below "

DENATURED ALCOHOL

20	percent	20	degrees above	zero
30	"	10	"	"
40	"	2	"	"

Previous to adding these solutions to the radiator, it should be put in condition to resist leakage and consequent loss of material. The preparation of a cooling system before the anti-freeze is added, may result in a direct and considerable saving, as loss by leakage will be a steady loss.

(a) Renew the circulating pump packing.

(b) Flush out the radiator with a solution made by adding two pounds of washing soda to enough boiling water to fill the system. Run it out before cooling.

(c) Renew the upper radiator hose connection. If the lower connection has been in use for more than a year, it may be advisable to renew this also.

(d) Look for leaks around the petcocks, gaskets, pump drain, hose clips or in the radiator.

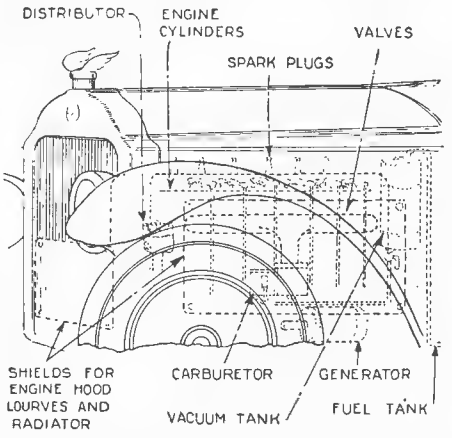
(e) Radiator leaks should be soldered, if possible, otherwise a tablespoonful of ground flaxseed meal or some good advertised anti-leak compound can be put in the radiator, to seal against slight seepage. This is a poor substitute for skillful soldering.

The illustration shows the average circulating system and the points of inspection.

ENGINE ADJUSTMENTS FOR WINTER DRIVING

When the engine sputters, spits back through the carburetor, stops suddenly or fails to start, there is a definite cause for such actions. The satisfaction of having a car which can be started and driven away regardless of the cold, makes the preliminary work of adjustments time well spent.

The attached sketch shows the major items which should be adjusted for successful winter driving.

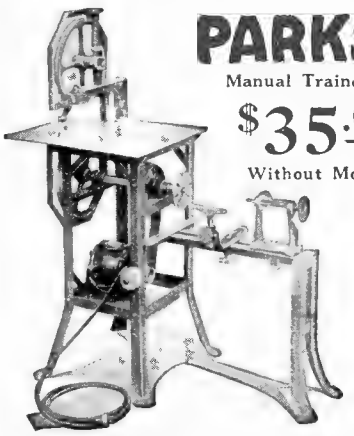


Illustrating points to be "tuned up" for winter driving.

The instruction book for the car gives the details of carburetor adjustment for winter. This is important and should be attended to.

The ignition system is of second importance. The spark plugs should be cleaned or renewed and the points set 1/32 inch apart.

(Continued on page 734)



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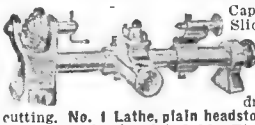

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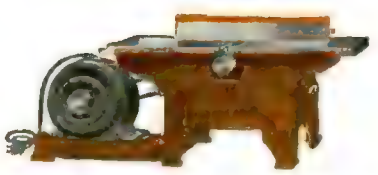

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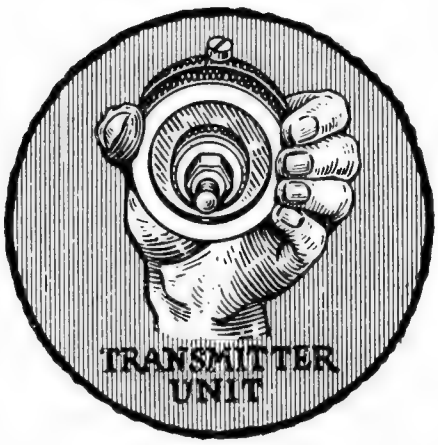

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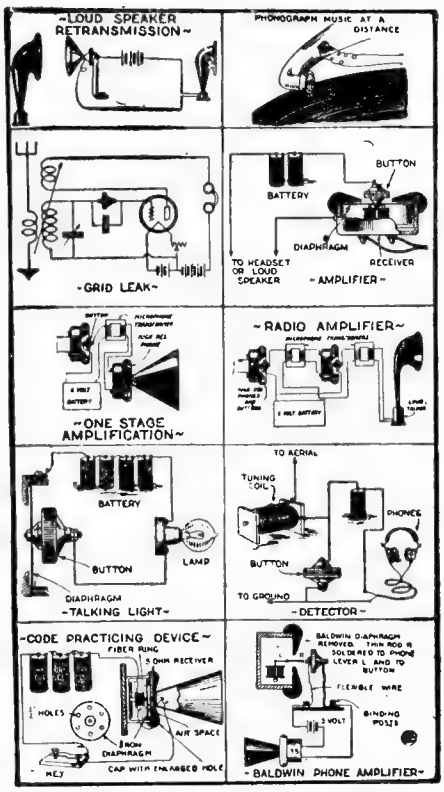

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Motor Hints

(*Continued from page 732*)

The contact points of the distributor should be filed true and set for a gap of .03 of an inch.

The carburetor intake connection should be set so that only hot air is used in the fuel mixture.

Valve adjustment should be made to insure a clearance at the lifters. A gap of .02 of an inch is desirable between the valve stem and lifter for winter operation.

The carburetor, vacuum tank and main tank should be drained free of any water accumulations which would freeze and stop the fuel supply.

Engine should be free from carbon deposits, using carbon remover.

Generator should be made to deliver fifty per cent more current by setting up the third brush.

Engine hood louvers should be closed and half the radiator covered, the lower half preferably. Heavy cardboard is suitable for this use.

A Folding Writing Table

(*Continued from page 718*)

top flush with the rear edge and in central position. When in use, the rear edge of the attachable table top rests upon the drawer of the Library table, which is withdrawn for the purpose, and the piece which has just been added, should fit snugly between the sides of the drawer.

Cut two pieces 28″ long from the 1″x1¾″ stock for the table legs. Lay the table top upon the floor or bench and place the legs in closed position, as shown in the cut, upon it. Cut two pieces of 1″x1¾″ stock 8″ long, and glue them in position to the table top, in fairly close contact with the legs. These 8″ pieces may be cut tapering at their rear ends. The table legs swing between the 8″ pieces and the 18″ pieces glued along the ends of the table top. The tops of the legs should be cut semi-circular in form and the legs should be drilled to receive the screws. When the glue on the 8″ pieces and the 18″ end pieces is dry, they should also be drilled for the screws. The legs may then be screwed into place.

Open the legs in order to ascertain the height at which to place the side rail. The rail should be placed high enough to limit the outward swing of the legs. Close the legs and screw on the side rail.

Wooden buttons are used to secure the top of the folding table to the top of the Library table. The buttons are screwed on with 2-⅜″ screws to the ends of the 1″x1¾″ pieces glued to the ends of the table top.

When the folding table is in position, and the buttons are turned upward, they engage the inner surface of the strip or rail that extends around the top of the Library table. If the Library table has a solid top, small lugs may be made and screwed to the under surface of the top, in position to receive the buttons.

Another method of attaching the writing table to the Library table, is to use right-angle screw hooks and eye screws, as suggested in the drawing. The hooks should fit closely in the eyes of the screws, so that there will be no vibration of the writing table.—*By C. H. Patterson.*

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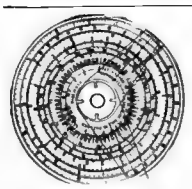

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Building a Model of the U. S. Brig of War "Truxton"

By WILLIAM A. CROSBY

(Continued from page 714)

hold it down. These sheets are started from a point near the end of the boom, to a bead arranged on the rail opposite the forward end of the after grating. The rope leads through these beads, one on each side, to another bead on the spanker boom directly opposite the rail beads, through these beads and back again through the bead on the rail and thence forward to the pin rail on the sheathing.

The spanker gaff is shorter and is raked up at a more acute angle than the boom. It is held up by halyards, the first set starting with a knot near the outer end of the spanker gaff and running through a bead on the after side of the main top and thence down to the fife rail. This is called the peak halyard.

The throat halyard starts in close to the mast and runs up through another bead on the after side of the main top and thence down to the fife rail. In order to hold the spanker gaff amidships, two ropes are run down from the outer ends to the side pin rails. These ropes are called the vangs. To the extreme end of the spanker gaff, a double halyard is arranged and run down to the after grating. On this halyard the United States ensign is raised, with the usual number of stripes but with 19 stars arranged in the form of one big star. That was the form of the flag used in those days.

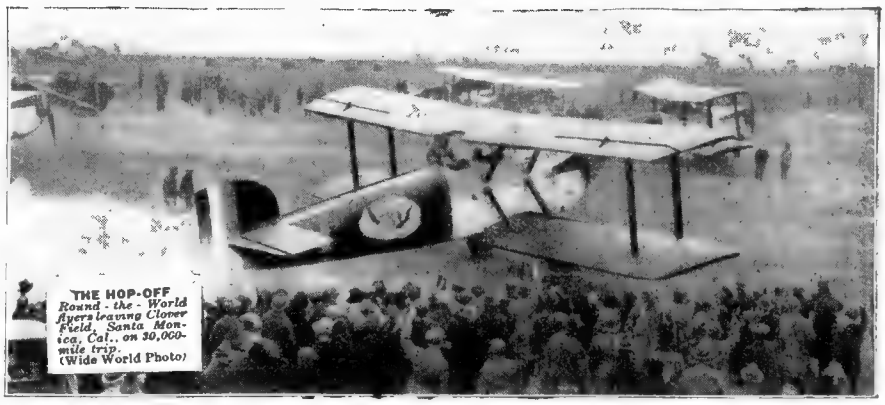
This flag, by the way, will be quite large, for in 1842, the United States was a young country and had been successful in naval engagements. They felt rather "cocky" over their successes and all American craft carried huge ensigns—much larger than those in use today.

The flag may be made of cloth, but a better job may be made by using a piece of white paper and carefully painting the stripes, blue field and stars on it.

There are a few other little details to be taken care of. Among these will be arranging a small boat to hang on the davits over the stern. This boat is eighteen feet over all which means that it will actually measure two and a quarter inches long. It may be cut from a block of soft pine, 48, and painted white and with little eyes in it. A piece of thread may be arranged to go through these and through the eyes, which should be arranged in the under side of the davits thence leading the rope forward to a little pin which should be passed through the davits forming a cleat.

The anchors should also go into place. You may buy these already made or you may easily make them yourself. In making them, cut the shape in a piece of soft pine and then into this mold, pour hot solder or lead. When it is cooled, remove the metal carefully so that it does not break and then with a small round file, file off the rough edges and make the shank round and smooth. The palms, at the ends, may be formed by clasping the metal in a large pair of pliers and squeezing it until it is flat, then filing each until the proper shape is obtained, 49.

Through the upper end of the anchor, a wire ring may be placed after a hole has been bored. The stock is made of wood and is glued to the proper place after which the entire affair is painted black. It is hung outboard with the ring fastened to the wire eye in the end of the cathead, 50, and the palm arranged over the deck rail and lashed in place. From the same anchor ring, a piece of chain may be run down to hawse pipes which may be bored in the bows about one third of the way between the water line and the rail. The end of the chain is pushed into this hole and made to stay with glue. Two complete anchors will be needed, one



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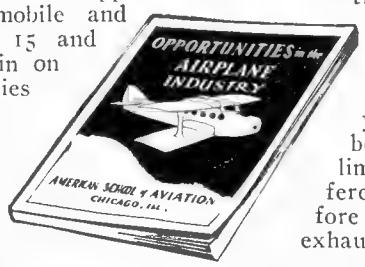

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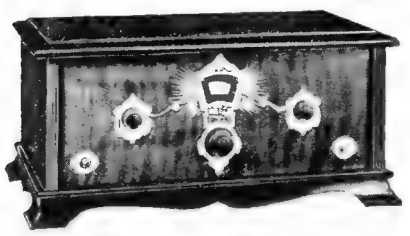

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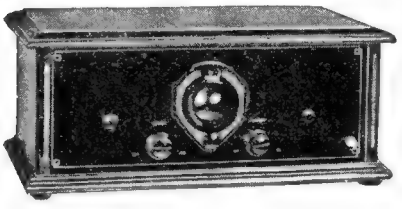

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for each side of the ship. If you wish, the hawse pipe may have a lip of cardboard arranged around it so that the rough edges are covered.

The model is now practically complete. You may find it necessary to go over it here and there to touch up the paint work, but it is really finished. If you wish you may put another boat on deck arranged on skids over the main hatch and you may also lash extra yards on deck, some of them eight sided and not even finished, but these are not essential to the model and may only clutter up the deck with too much stuff.

The whole point of construction is to gain a knowledge of how these ships were made and how they looked, and as you go on with the work you will be surprised to find yourself figuring out how the different sails were handled under varying conditions. As stated at the beginning, model making is no thing to hurry. Each little knot must be made just so and glued in place, the painting alone should take considerable time for it is a finicky job and you should be careful not to permit the paint to lap over thus spoiling the effect. Half the beauty of a model is to do these things neatly and with a sure hand and plenty of patience.

If you find yourself hurrying up and in danger of spoiling the model, put it away for a few days when you will return to it with renewed interest and a better understanding of what should be done. A well made model of any ship is worth at least $150.00 and in many instances the prices have been double and treble this. The better you make the job the more the model will be worth to you and the more it will be worth if you try to sell it.

A Handy Battery Motor

By A. LATHAM

(*Continued from page 716*)

There should be about four layers of this wire on the field. After we have the motor completely assembled, we can put two terminals on the base and from one of these run a wire to one of the brushes. The current from it is carried through the contact on the commutator. From one contact on the commutator the current goes to the outside wire on one coil of the armature. The inside wire of this coil is connected to the outside wire of the other coil; the inside of this coil is connected to the other brush; from this brush the current goes to the field coil and the field coil is connected to the other base terminal. The motor is timed by having the brushes just starting on contacts as the armature is starting to leave a horizontal position. The armature can be made to stay in its place and keep from shifting from one side to the other by using short pieces of copper tubing inside of the frame slipped over the shaft. A small pulley may be mounted on the shaft for the transmission of power.

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Huge Telescope To Probe Sky

By W. J. LUYTEN

(*Continued from page 703*)

in South Africa will be the first instrument of modern possibilities under the southern sky. It is hoped, therefore, that if the new telescope is built it will be located somewhere south of the equator, rather than on Mt. Wilson, where observing conditions are getting poorer every day on account of the hindrance from the lights of the growing metropolis of Los Angeles.

WHAT THE 300-INCH REFLECTOR WOULD SHOW

Finally, to give a short review of the things the new telescope is expected to accomplish:

Beginning at home, it is hoped that this new telescope will give us conclusive information about the mountains on the moon, what they are made of and how they originated. With a telescope 300 inches in diameter one could see things on the moon as small as a city block. Which means that if the inhabitants of the moon had one like it they could probably watch the construction of a skyscraper right here in New York, and under favorable conditions they might be able to watch the Leviathan cross the Atlantic or the Twentieth Century on its run to Chicago. And the planet Mars we could bring so close that we could study its climate in much greater detail than is now possible, and find out whether or not its surface is habitable. The other planets, Venus, and Jupiter especially, so remote that we now know very little about them, might be brought within reach of accurate measurement.

But the most substantial gain would be made in the realm of the fixed stars. The new telescope with its light-gathering power *nine times greater than that of the largest existing telescope,* would reveal at least three times as many stars as are now known. Especially would it help us in the detection of our immediate neighbors, of those very faint objects, more than 10,000 times fainter than the sun in light output. Our present observations lead us to suspect that there are a great number of such stars, the only reason that we do not find them is that they are so faint that even the hundred-inch telescope will not reveal them. With the aid of various accessories, such as the spectroscope and the photo-electric cell, the new 300-inch reflector will teach us a lot about all sorts of interesting objects, variable stars, spectroscopically double stars, new stars, nebulae composed of incandescent gases, stars that are shooting through the universe at speeds of more than 500 miles a second, etc., most of which we now know exist, but which are out of sight with our present means.

Lastly, a 25-foot reflector will aid us no end in our search for information about spiral nebulae, about "island universes." Such a powerful telescope would reveal to us the fine structure of the nearest of all islands, of the Magellanic Cloud; it would tell us a great deal about the variables in the Andromeda Nebula, on which, after all the scale of the universe is based. And it would give us an answer to the great question: are there any island universes beyond 100,000,000 lightyears? Is Space filled with them in all directions, or do we approach the end somewhere? With such a telescope a conglomeration of stars as vast as our own Milky Way system could be seen up to a distance of at least 10,000,000,000 lightyears, and would make us feel at ease to know that we are or are not the largest single unit in creation.

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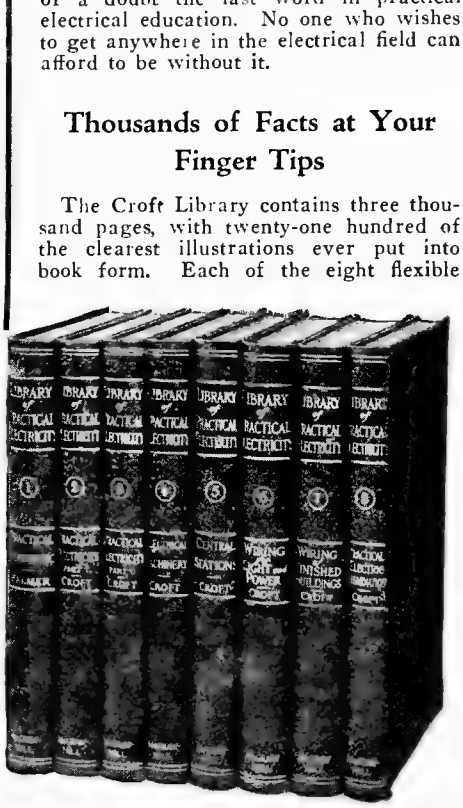

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Edited by
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RUBBER HAT COVER AND FRUIT PICKER

(1051) H. E. Smith, Oshawa, Ont., Canada, writes: Do you think it would be advisable to get a patent for an article which would aid in the picking of fruit? It consists of a long rubber tube and of a bore slightly larger than the fruit which is to be picked. One end is fastened to the basket and the other end is fastened to the fruit picker. The object of the device is to enable the fruit to be plucked and it will then slide through the tube directly into the basket.

Also, do you think it would be advisable to protect an idea for a rubber cap which could be slipped over the hat in time of rain and would normally be kept in the pocket of the slicker, in this way one would not need the cumbersome umbrella.

A. 1. Neither of the two suggestions which you have made are new. The fruit picker has been described time and again in Science and Invention Magazine and undoubtedly in many other publications.

The hat protector has already been covered by patents and several organizations have tried to place it on the market with but little success. We do not advocate any further procedure.

MOTOR BOAT

(1052) Amaden Feia, New York City, N. Y., has designed a new system for motor boats which he believes will produce speeds heretofore unheard of. The idea is to mount a boat on a series of drums so that the boat floats on the drums. The drums in turn are connected to the vessel by a shaft and are free to rotate about this shaft. He believes that in this way he will eliminate friction because the drums will turn on the surface of the water. He asks our opinion.

A. 1. We doubt very much if you will be able to secure any great speeds with the system designed by you. It is nearly as easy to push a barrel in the water as it is to roll this barrel in the same medium. The friction which exists between the water and the drums and that existing between the water and a vessel presenting the same frictional contact area, would be so slight that you would scarcely notice any appreciable change. We certainly would not advocate that you proceed with applying for a patent on this suggestion, unless your own experiments convince you that the idea is thoroughly practical and that you will get desired speeds. We doubt it.

SHOE LACING

(1053) Bunyan Kennedy, McCool, Miss., asks us what we think of an idea for an improved shoe lace. He states that some time ago we wrote an article on improving the modern shoe lace and believes that he has accomplished it by placing downwardly depending hooks along the lace edges. He intends to use but a single shoe lace for closing the shoe.

A. 1. We think that your idea is a poor substitute for the modern hooks. With these, the shoe can be laced much quicker than one could possibly lace the style of shoe designed by you. In addition to that, the modern hooks do not present the metallic surface in close proximity to the foot and there is very little possibility of the stocking being torn by catching those hooks. We certainly would not advocate that you apply for a patent on the system because we think it is inferior to present-day constructions and consequently, it is doubtful if you could secure a market for the same.

AIRPLANE

(1054) Joseph Hodkinson, Jr., Chicago, Ill., intends to build an airplane in which the propeller of the plane is to drive the plane forward and this in turn is to be operated by an electric motor. The motor is to secure its power from storage batteries when the plane leaves the ground and after it is in the air, two additional propellers connected to generators are to continue to furnish power to drive the ship.

A. 1. It will not be necessary for you to build the plane to test whether or not your system is practical. Merely take two electric fans; connect one of them to a source of current supply and then place the other one in front of it. The blades of the second fan will soon revolve, due to air pressure and you can then couple the circuits so that one fan will act as a generator and the other as a motor and determine whether or not the system will operate. If you believe that by this arrangement you cannot take advantage of "additional" air currents, we advise you to place one fan near the end of a board 8 or 10 feet long, pivot the board at the center and mount a roller skate at the free end. Then add two or three additional fans to act as the generators. The system would be much like perpetual motion and we doubt very much if you will get any result from it whatever. We certainly would not advocate applying for a patent.

AIRPLANE PARACHUTE

(1055) James Page, Brooklyn, N. Y., submits an idea for an airplane parachute which opens very much like an automatic umbrella, i.e., the type which upon pressing a button spreads itself.

A. 1. You intend to make every aviator wager his life against the operation of a spring. While the method is conceivably possible, it certainly is not practical. It would necessitate a very long spring and consequently, a rather long staff to permit of such opening and the aviator could at no time guarantee that the article would operate. We certainly prefer the modern style of airplane parachute to the method outlined by you and we would not, under any circumstances, advocate protecting the idea further because we do not believe you could secure a market for the same.

SELF-COOLING PITCHER

(1056) M. D. Aiken, Wilson, N. C., submits a canvas pitcher for holding water which by seepage and evaporation, should keep the water in the bag cool. His system for mounting the same is rather unique.

A. 1. We are of the opinion that the article designed by you should be quite good, particularly as an aid for campers and we would suggest that you build a model of the same and likewise have a patent search made on the article. If you find that the patent search reveals no similar patent, you might proceed further with the suggestion. If correctly designed and manufactured, the article could be cheaply sold and make a reasonable profit for both manufacturer and inventor.

(*Continued on page* 740)

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Patent Advice

(*Continued from page 738*)

RADIO AND PISTOL

(1057) Edward C. Johnston, Pittsburgh, Pa., submits a suggestion for a radio set in a pocket-book and another for a single shot pistol. He asks our opinion.

A. 1. The idea of putting a crystal set in a pocket-book is not new and a book radio was at one time sold on the market for 50c complete with crystal, tuning inductance, etc. We do not advocate applying for a patent on a similar suggestion and doubt that you could possibly protect it.

The single shot pistol made in the form of a fountain-pen may be quite good as a novelty, but it is doubtful that you could get any sale on the same in view of the ever-spreading laws against the use of fire-arms.

Single shot pistols in the form of knives and other articles of everyday use are well known. Consequently, it is not to be advocated that you attempt to protect your suggestion.

GLAZING MACHINE

(1058) Joseph Goscher, Paterson, N. J., asks our opinion on a glazing machine in which putty travels through rubber tubes from an air-proof tub.

A. It would be impossible for us to hazard any opinion on the idea advanced by you with the very few details which you have given concerning the same. You do not mention exactly what you mean by an air-proof tub. Is the putty to be placed under air-pressure and driven out by the air pressure or is the air-proof tub merely intended for preventing the putty from drying out? Neither do you state how this putty machine is to operate. At the present time there is a small sized article of this nature on the market and unless your system is much superior to the existing device, we would certainly not advocate that you apply for a patent on the same.

SPAGHETTI COOKER

(1059) Harry V. Stanfield, Jackson Heights, N. Y., submits an idea for a macaroni or spaghetti cooker, consisting of two pots, the inner one of which is perforated, thus serving as both pot and strainer.

A. 1. We do not see that your suggestion is new and it is doubtful that you can protect the same with a patent. While protection might be obtained on a technicality, we do not believe that the claims would be broad and basic enough to warrant further procedure.

AIRPLANE BLOCK

(1060) Martin Michlik, Trenton, N. J., submits a suggestion for an airplane block made of aluminum and arranged with a chain so that it can be pulled away from under the wheels of the airplane from either side of the vessel, instead of from in front of the ship.

A. 1. We are of the opinion that there is not a sufficient demand for an article of this nature to warrant protecting it with a patent. The wooden blocks which are now in use could easily be secured to a chain and a cable without in any way infringing on your idea and would serve the purpose as well as aluminum. In addition, they are more resilient and they can be knocked about which rough usage one could not give your article. We do not advocate patent procedure.

AIR SPEED INDICATOR

(1061) W. B. Simmons, Sacramento, Calif., has requested our opinion on a device which will give the actual speed of an airplane during flight and also show the wind speed. He requests our opinion.

A. 1. Inasmuch as you have given no details concerning your article, it will be difficult for us to advise you as to whether the suggestion is worthy of further protection. There are devices today which enable the aviator to determine his speed and likewise to determine the air speed. If your system is superior to existing articles and if it will give direct reading on a gauge or other indicator, it might be advisable to protect it with a patent. If, on the other hand, the system requires considerable calculation or manipulation with slide rules or other mechanisms, it would not be suitable for use on an airplane. If the method is extremely bulky, it would likewise be contra-indicated. Without details we can give no further counsel.

SPLIT RIM TOOL

(1062) J. C. McAlister, Yellow Grass, Sask., Canada, requests our opinion on an article for springing the split rims on a Ford. This article is in the form of a bent belt, provided with a turn buckle at the center.

A. 1. The system which you have designed is not new and if memory does not fail us, was in actual use approximately eight years ago. Since that time the article has been replaced with a method employing a lever which is far more suitable to the suggestion you made inasmuch as full traction can be obtained on the lever and it is not necessary to skin the knuckles while attempting to turn the turn buckle. We would not advocate applying for a patent on the suggestion.

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The Metal Emperor

By A. MERRITT

(*Continued from page 707*)

WE START ON A MYSTERIOUS JOURNEY

THE cubes moved with entire absence of vibration; so smoothly and skimmingly, indeed, that had it not been for the sudden wind that had risen when first we had stirred, and that now beat steadily upon our faces, and for the cloudy walls streaming by, I would have thought ourselves at rest.

I saw Ventnor drift toward the forward edge. He walked oddly, as though wading. I essayed to follow him. I could not lift my feet, and found I could advance only by gliding them over the surface, as though skating. It was as though, up to my hips, I moved through a closely woven yet fluid mass of cobwebs. I had the notion that if so willed I could slip over the edge of the blocks, and crawl about their sides without falling—like a fly on the vertical faces of a huge sugar loaf.

I drew beside Ventnor. He was staring ahead, trying to pierce the mists for some glimpse of Ruth.

"Can you see them, Thornton?" His voice shook. "Why did I let her go alone?"

"Norhala raised her hand high above her head. Up from the darkness flew another shape—a monstrous, armed, flat-backed crab, angled spikes protruded from it, its huge body spangled with darting, greenish flames."

"They'll be close ahead, Martin," I said. "Whatever it is we're bound for, wherever it is the woman's taking us, she means to keep us together—for a time at least. I'm sure of it."

Drake's rifle slipped from his hand and fell. As it struck the block there clanged forth a curiously high, metallic note, muffled instantly as though the sound had been sucked in. He stooped to pick it up and hesitated incredulously, then tugged at the stock with both hands. The rifle lay immovable.

He pushed it and it slithered away from him. I bent and strove to aid him. For all the pair of us could do, the rifle might have been part of the gleaming surface on which it rested. The tiny, deep-set star points in the thing winked up.

"They're laughing at us!" whispered Drake.

We heard a cry from Ventnor. We straightened up. Our heads shot above the mists like those of swimmers from water. They lay all about us like a level sea. A hundred yards ahead of us was the woman, veiled in the vapors almost to the shoulders. Pressed to her shoulder was the curly brown

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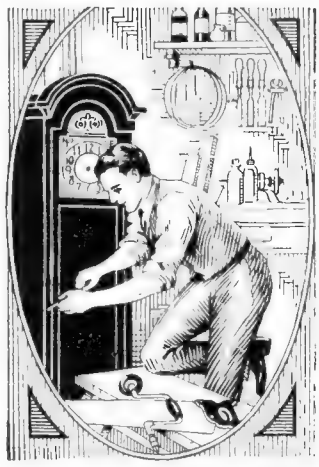

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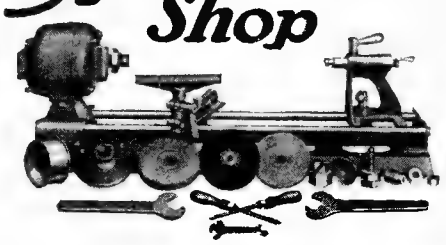

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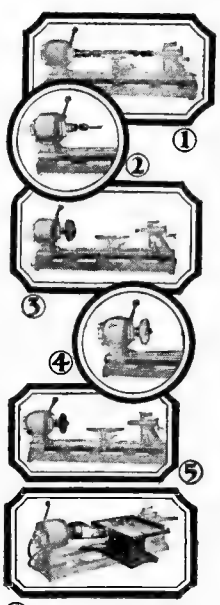

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head of Ruth. At her brother's cry she turned. Her arm flashed out to him with reassuring gesture.

We were speeding toward an opening in the valley's mountainous wall a full mile away. It was no ragged crevice. It gave the impression of a gigantic doorway.

"Look!" cried Drake.

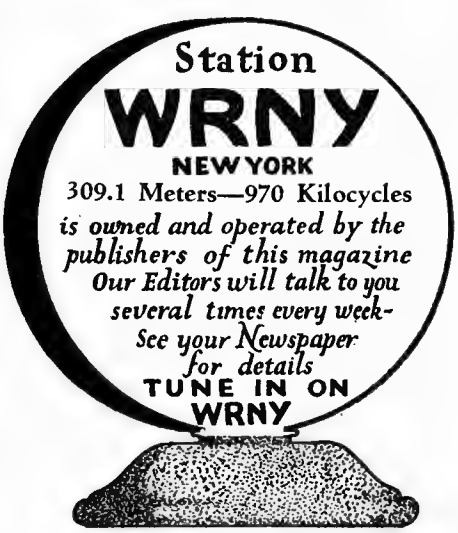
Between us and the gateway, gleaming angles began to break through the mists, like the cutting fins of sharks. There were glints of round bodies like enormous porpoises. The vapors seethed with them. Rapidly we neared the portal. Now the fins and rolling curves were all about us. They centered upon the portal and streamed through—a horde of the metal things, leading us, guarding us, playing around us.

Weird, inexpressibly weird was that spectacle—the vast and silent vale with its smooth mists like a coverlet of cloud; the lovely head of the lightning witch sweeping through them; the dull glint and gleam of the metal mysteries flowing in ordered motion all about us; the titanic, glowing gateway—

We were in its threshold. We were over it.

CHAPTER IX

THE THING THAT FOLLOWED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TUNE IN ON WRNY

UPON that threshold the mists foamed like billows, but did not enter.

I could not determine whether the place into which we had passed was canyon or tunnel. I could see neither sky nor roof. Ahead of us glided the block that carried Ruth and Norhala. The woman still held the girl close to her. In front of them swept score upon score of her familiars, no longer dully lustrous but shining as though cut from blue and polished steel. Looking behind me, I saw other scores of the metal things darting through the spume at the portal.

The walls were perpendicular. They glittered palely with a greenish, metallic sheen. They were of rock, but rock that seemed to have been planed and plated. And the meticulousness, the perfection of these smoothed cliffs struck over my nerves as no rasp could, stirring a vague resentment, an irritated desire for human unharmonies and human disorder.

"If we get close enough and I can get my feet loose from this damned thing I'll jump!" muttered Drake, close beside me.

"What?" I gasped, startled out of my preoccupation. "Jump where?"

He pointed. We were rapidly closing upon the other cube. It was now a scant twenty paces ahead, and it seemed to be stopping. Ventnor was leaning forward, quivering with eagerness.

"Ruth!" he called. "Ruth—are you all right?"

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Slowly, she turned to us—my heart gave a leap, then seemed to stop. The girl's face was touched with that same unearthly tranquility which was on the woman's, and in her brown eyes was the shadow of that passionless spirit brooding in Norhala's own. And her voice as she answered held within it more than echo of Norhala's faint, far-off golden chiming.

"Yes," she sighed, "yes, Martin—have no fear for me—"

I glanced covertly at Ventnor, at Drake—had I imagined, or had they too seen and heard as I. Ventnor's face was white, and Drake's jaw was set, his teeth clenched.

"Ruth!" There was anguish in Ventnor's call

She did not turn; it was as though she had not heard him.

The cubes were less than five yards apart. Drake gathered himself, and strained to loosen his feet from the shining surface, making ready to leap. Sweat streamed down his face.

"No use," he gasped, "no use!"

"Ruth!" cried Ventnor again.

The block so near darted forward, resuming the distance it had formerly maintained between us. The vanguard of the metal things began to race with incredible speed. They fled away. The cube that bore the woman and the girl accelerated its own motion. It flew faster and faster. As swiftly, our own followed it. The walls flowed by, dizzily. There was a little wailing chorus behind us.

The things that followed were racing down upon us like a wave. Fifty feet in the air was the crest of that wave—and even in that moment of panic I noted with what mathematical regularity the spikes of the pyramids tipped it, and with what awesome orderliness cube and sphere were placed. Half across the cleft it stretched—not so much wave or avalanche as curtain, two hundred feet wide and a fourth of that as high.

Closer it came and closer. Now its rigid, shining, knobbed and spiked front was almost on us. Out of it stared the myriads of steady, mocking eyes. We cowered, waiting for it to break, and crush us.

A movement began in it. Ball and square and pyramid writhed and spun and threaded. Its middle began to contract as if an unseen cable were drawing in its sides. There was an infinitely rapid shifting.

The curtain was gone!

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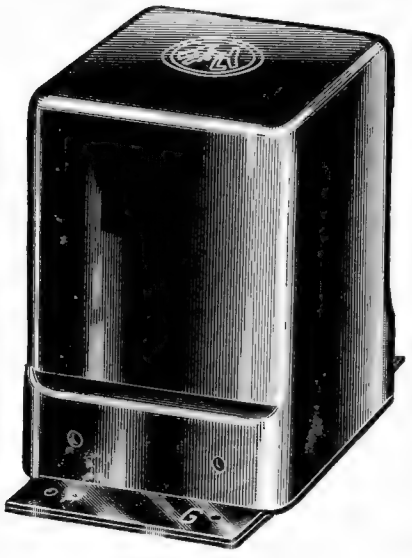

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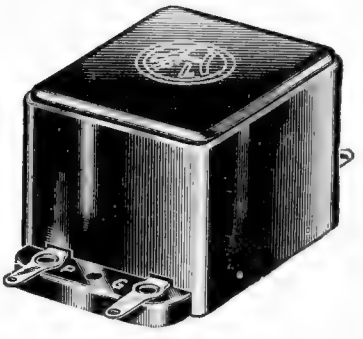

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In its place, gliding after us, was a colossal figure, gigantic mate to that which had shattered the armored men, yet not of any of its shifting shapes, and to it in size as that had been to the pigmy of the ruins.

Difficult—difficult beyond thought is it to picture in words that prodigy following us; built though it was from most familiar forms—of nothing but globes and blocks and four-sided wedges, shapes commonplace and normal. It was their basic simplicity that pointed the lance of terror—the stark horror of the obvious transformed into the unfathomable.

The height of fifty tall men it arose, towering upon four slender, stilt-like legs made up of alternate spiked six-foot block and ball. The spidery legs supported a huge cylindrical body, from the top of which a quintet of the girdered cubes, each twenty feet long, thrust themselves. They radiated like a five-pointed star, and over their length, swarming out of the body like bees from a hive, flashed scores of smaller spheres and blocks. These clustered at the ends of the girders. They shifted,—and at each end was now a monstrous thirty-foot wheel, its hubs the globular clusters, its spokes the cubes and its rims great, tetrahedron-tipped spheres.

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And all these changes had been made while it maintained its steady, gliding pace close behind us.

"Professor," said Drake. "Do you suppose this lad is entertaining us, or just amusing itself?"

"It's no laughing matter, Drake," I answered, sternly, irritated by his flippancy. "And no time for levity," I added even more tartly, for the wheeling crests had doubled, the abrupt action pulling every one of my nerves taut as a bowstring.

"I'll say it's not!" he exclaimed. "You put it in an nut-shell, Professor. You certainly have sized up the situation with an amazing and original brevity."

I flushed at the broad sarcasm.

"But at that we're dead wrong," he went on. "What the hell! If we don't laugh at it we're lost, aren't we? If I had a barrel of the old familiar brew here I'd sit on it and twine vine-leaves in my hair, and sing to that bird to show it just how much I'm afraid of it. Well, all it can do is kill us!"

"It's not death I fear," broke in Ventnor. "It's what that witch is doing to Ruth's soul!"

The five wheels that crowned the top of the figure began spinning; they revolved upon their own axes, and circled slowly around the—neck—of the thing itself. As they spun, each wheel tipped, hung over us, staring with the countless star points even

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as the hobgoblin of the ruins had stared up at me—and with the same curiosity.

"If there were enough of them they could walk across the ocean," muttered Drake. As though it had heard him and understood, the thing gently lifted one of its four stilts, extended it leisurely over us, undulated it, then placed it deliberately, and daintily, directly in our path. There was something hideously spiderlike in the movement. Lower came the huge body, and lower, threatening to crush us.

Two of the legs drew up toward the trunk, joined ends, threw themselves loose from the—hips—and became a vast and sparkling ring, circling it so swiftly that it seemed to be a wide and solid band of polished steel. The five wheels were now only a blur.

The legs began a rapid buckling and straightening, like the flexing of immense springs. There came again the curious wailing sounds. Up rose the five wheels and merged, as they lifted, into one enormous circlet, and spun, like a huge, sparkling pinwheel, high up in the green haze.

And vanished within it.

"It was a—city! A city a full mile high and crowned with countless spires and turrets, arches and domes. It was as though the man-made cliffs of lower New York were raised scores of times their height, stretched a score of times their length. And weirdly enough did that stupendous pile suggest those same towering masses of masonry when one watching from Brooklyn Bridge sees them thrust up and out against the twilight skies. . . ."

CHAPTER X
THE DRUMS OF THUNDER

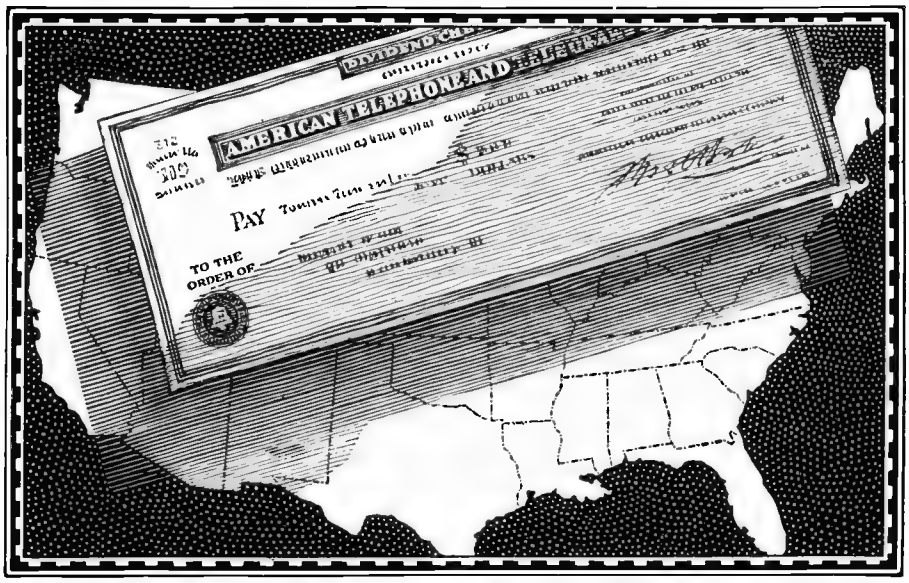
THE Thing now appeared to be headless—a decapitated grotesque shape hovering over us. From on high came once more the wailings.

Into view whirled the colossal ring, yards in advance of us. Down it swept, was drawn back like a leaf in a draft, swerved, and clicked into place on the monstrous body.

The Thing trembled, ran together, melted and was gone, dissolved into a host of spheres and blocks and pyramids that followed in our wake like a quiet, reaching wave—gently and sedately.

We had swept over toward the right wall of the cleft and were gliding over a broad ledge. This ledge was, I judged, all of a hundred feet in width. From it, the floor of the place was dropping rapidly. The opposite precipices were slowly drawing closer. Our ledge steadily arose over the floor of the canyon. The character of the cliffs changed. Veins of quartz shone under the metallic plating like cut crystal, like cloudy opals; here a splash of vermillion, there a patch of amber; bands of pallid ochre stained it.

A line of inky-blackness appeared in the exact center of the falling floor. It widened. Blackness welled up within it, black-



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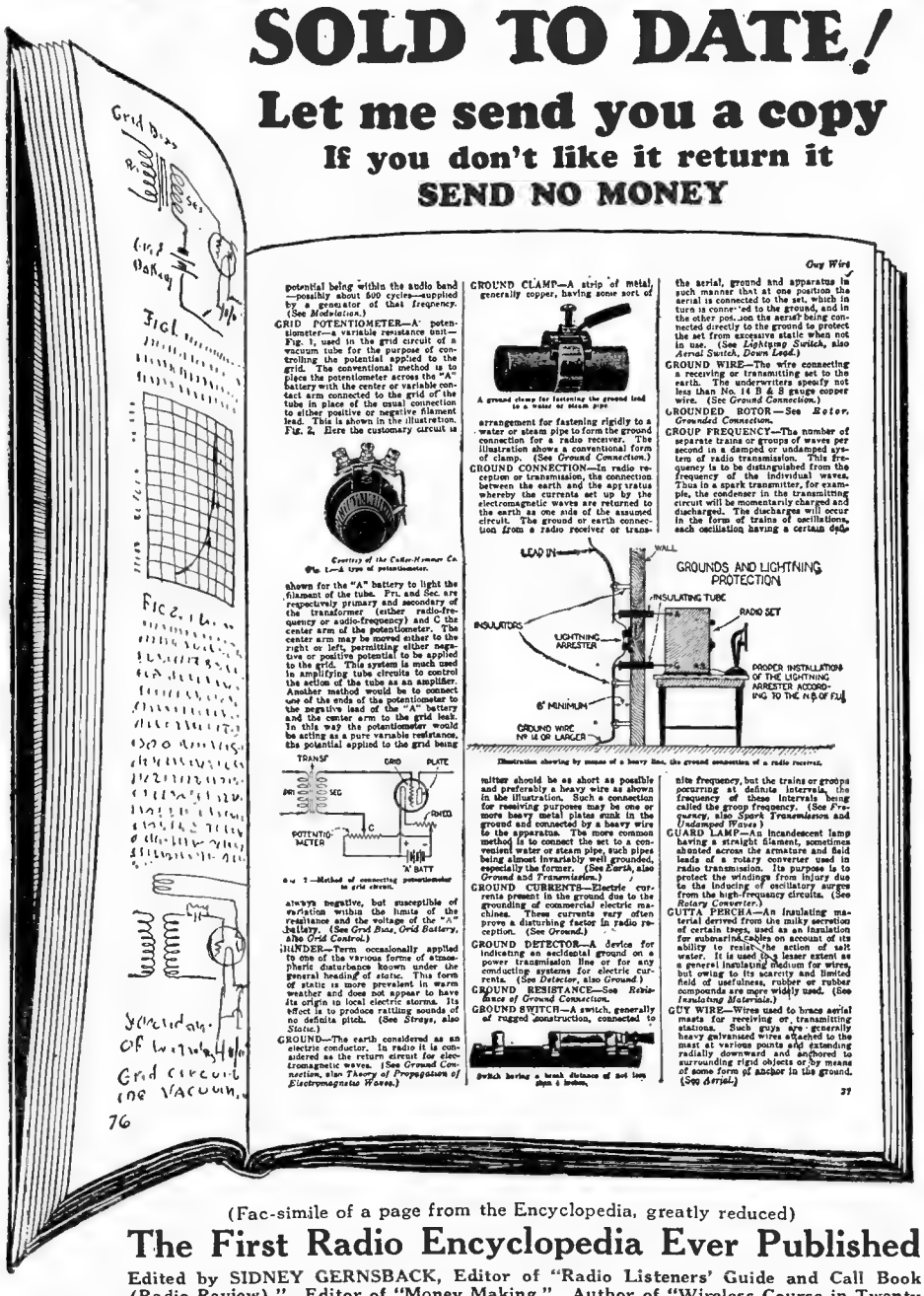

potential being within the audio band—possibly about 500 cycles—supplied by a generator of that frequency. (See *Modulation.*)

GRID POTENTIOMETER—A potentiometer—a variable resistance unit—Fig. 1, used in the grid circuit of a vacuum tube for the purpose of controlling the potential applied to the grid. The conventional method is to place the potentiometer across the "A" battery with the center or variable contact arm connected to the grid of the tube in place of the usual connection to either positive or negative filament lead. This is shown in the illustration, Fig. 2. Here the customary circuit is shown for the "A" battery to light the filament of the tube. Pri. and Sec. are respectively primary and secondary of the transformer (either radio-frequency or audio-frequency) and C the center arm of the potentiometer. The center arm may be moved either to the right or left, permitting either negative or positive potential to be applied to the grid. This system is much used in amplifying tube circuits to control the action of the tube as an amplifier. Another method would be to connect one of the ends of the potentiometer to the negative lead of the "A" battery and the center arm to the grid leak. In this way the potentiometer would be acting as a pure variable resistance, the potential applied to the grid being always negative, but susceptible of variation within the limits of the resistance and the voltage of the "A" battery. (See *Grid Bias, Grid Battery,* also *Grid Control.*)

Courtesy of the Cutler-Hammer Co.
Fig. 1—A type of potentiometer.

Fig. 2—Method of connecting potentiometer in grid circuit.

THUNDER—Term occasionally applied to one of the various forms of atmospheric disturbance known under the general heading of *static.* This form of static is more prevalent in warm weather and does not appear to have its origin in local electric storms. Its effect is to produce rattling sounds of no definite pitch. (See *Strays,* also *Static.*)

GROUND—The earth considered as an electric conductor. In radio it is considered as the return circuit for electromagnetic waves. (See *Ground Connection,* also *Theory of Propagation of Electromagnetic Waves.*)

GROUND CLAMP—A strip of metal, generally copper, having some sort of

A ground clamp for fastening the ground lead to a water or steam pipe.

arrangement for fastening rigidly to a water or steam pipe to form the ground connection for a radio receiver. The illustration shows a conventional form of clamp. (See *Ground Connection.*)

GROUND CONNECTION—In radio reception or transmission, the connection between the earth and the apparatus whereby the currents set up by the electromagnetic waves are returned to the earth as one side of the assumed circuit. The ground or earth connection from a radio receiver or transmitter should be as short as possible and preferably a heavy wire as shown in the illustration. Such a connection for receiving purposes may be one or more heavy metal plates sunk in the ground and connected by a heavy wire to the apparatus. The more common method is to connect the set to a convenient water or steam pipe, such pipes being almost invariably well grounded, especially the former. (See *Earth,* also *Ground* and *Transmission.*)

GROUND CURRENTS—Electric currents present in the ground due to the grounding of commercial electric machines. These currents vary often prove a disturbing factor in radio reception. (See *Ground.*)

GROUND DETECTOR—A device for indicating an accidental ground on a power transmission line or for any conducting systems for electric currents. (See *Detector,* also *Ground.*)

GROUND RESISTANCE—See *Resistance of Ground Connection.*

GROUND SWITCH—A switch, generally of rugged construction, connected to the aerial, ground and apparatus in such manner that at one position the aerial is connected to the set, which in turn is connected to the ground, and in the other position the aerial being connected directly to the ground to protect the set from excessive static when not in use. (See *Lightning Switch,* also *Aerial Switch, Down Lead.*)

Switch having a break distance of 800 1000 degs. 6 inches.

GROUND WIRE—The wire connecting a receiving or transmitting set to the earth. The underwriters specify not less than No. 14 B & S gauge copper wire. (See *Ground Connection.*)

GROUNDED ROTOR—See *Rotor, Grounded Connection.*

GROUP FREQUENCY—The number of separate trains or groups of waves per second in a damped or undamped system of radio transmission. This frequency is to be distinguished from the frequency of the individual waves. Thus in a spark transmitter, for example, the condenser in the transmitting circuit will be momentarily charged and discharged. The discharges will occur in the form of trains of oscillations, each oscillation having a certain definite frequency, but the trains or groups occurring at definite intervals, the frequency of these intervals being called the group frequency. (See *Frequency,* also *Spark Transmission* and *Undamped Waves.*)

GUARD LAMP—An incandescent lamp having a straight filament, sometimes shunted across the armature and field leads of a rotary converter used in radio transmission. Its purpose is to protect the windings from injury due to the inducing of oscillatory surges from the high-frequency circuits. (See *Rotary Converter.*)

GUTTA PERCHA—An insulating material derived from the milky secretion of certain trees, used as an insulation for submarine cables on account of its ability to resist the action of salt water. It is used to a lesser extent as a general insulating medium for wires, but owing to its scarcity and limited field of usefulness, rubber or rubber compounds are more widely used. (See *Insulating Materials.*)

GUY WIRE—Wires used to brace aerial masts for receiving or transmitting stations. Such guys are generally heavy galvanized wires attached to the mast at various points and extending radially downward and anchored to surrounding rigid objects or by means of some form of anchor in the ground. (See *Aerial.*)

Guy Wire

Illustration showing by means of a heavy line, the ground connection of a radio receiver.

(Fac-simile of a page from the Encyclopedia, greatly reduced)

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ness that was the essence of the depths. It spread suddenly wide open in two sharp-edged, flying wedges—

Earth dropped away. At our side a gulf opened, an abyss, striking down immeasurably, depth upon depth.

Scores of the cubes darted from the host trailing us. They flashed by, and raced ahead. A gloom began to grow, and deepened until we were rushing into blackest night. The night was pierced by a long lance of pale blue phosphorescence.

I shielded my eyes with my hands against the hurricane wind and peered through the chinks of my fingers. Ranged directly in our path was a barricade of the cubes. I closed my eyes against the annihilating impact that seemed inevitable.

I heard an exclamation from Ventnor, felt that on which we rode lifting, and unclosed my lids.

We were soaring at a long angle, straight to the top of the barrier. We were upon it, and with unchecked speed were hurtling through the blackness over the lance of phosphorescence, that now I knew was another bridge of the cubes that but a little before had fled past us. Beneath the span, on each side of it, I sensed the void.

We were over, and rushing along in the darkness. There was a mighty tumult, a vast crashing and roaring. The clangor grew and beat about us with tremendous wings of sound.

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Far away was a dim glowing, as of the rising sun through heavy mists. Miles away, gleamed what at first glimpse seemed indeed to be the rising sun; a gigantic orb, whose lower limb just touched the blackness.

Lighter it grew about us. And ever louder and more thunderous became the clamor.

Now I saw that at the foot of the orb was a pool of flame. Into it, out of the depths, protruded a tremendous rectangular tongue, gleaming like gray steel. On the tongue appeared an inky shape. It was like a gigantic toad, squat and horned. For an instant it was silhouetted against the shining sphere—then vanished through it.

Silhouetted as had been the toad-like shape, the cube on which were Ruth and Norhala blackened into sight. It seemed to hover; to wait.

"It's a door!" Drake's shout beat thinly in my ears against the hurricane of sound.

The seeming orb was indeed a gateway. Light streamed through it. The flaming colors, the drifting shadows were beyond it. The suggestion of sphere had been an illusion, born of the darkness in which we were moving.

A STARTLING MONSTER

NORHALA raised her hand high above her head. Up from the darkness flew another shape—a monstrous armored, flat-

backed crab, angled spikes protruded from it, its huge body spangled with darting, greenish flames. It swept beneath us and by. On its back were multitudinous breasts from which issued blinding flashes—sapphire blue, emerald green, sun-yellow. It too hung poised, standing out jet-black, rearing upon columnar legs.

It vanished. In its place was the cube that bore Norhala and Ruth. Then they, too, were gone and we stood where but an instant before they had been.

We were high above an ocean of living light—a sea that stretched mile upon uncounted mile away, and whose waves streamed thousands of feet in air, flew in gigantic banners, in tremendous streamers, in clouds of varicolored flame—as though torn by the talons of a mighty wind.

Sight cleared. Within the sea of light swam shapes cyclopean, unnameable. They moved with an awesome deliberateness. From them came the volleys of the lightnings.

And now the tumult was as ten thousand Thors smiting with hammers against the enemies of Odin. As a forge upon whose shouting anvils were being shaped a new world.

A new world? A metal world?

The thought spun; and was gone. Abruptly the clamor had died, the lightnings ceased, the flitting radiances paled, and the sea of flaming splendors grown thin as mist.

Through the waning light and far, far away—miles high it seemed, and many, many miles in length—a broad band of fluorescent amethyst shone out. From it dropped curtains, shimmering and nebulous, as the marching folds of the aurora. They cascaded out of the amethystine band. Purple-black against them bulked what at first I thought a mountain, so like was it to one of those fantastic buttes of our desert when their castellated tops are silhouetted against the setting sun. Closer we came to it—

It was a—city!

A city a full mile high and crowned with countless spires and turrets, arches and domes. It was as though the man-made cliffs of lower New York were raised scores of times their height, stretched a score of times their length. And weirdly enough did that stupendous pile suggest those same towering masses of masonry when one watching from Brooklyn Bridge sees them thrust up and out against the twilight skies.

The pit darkened. The vast, purple-shadowed walls of the city sparkled with countless lights. From crowning arches and turrets leaped broad filaments of electric flame.

Was it my straining eyes, the play of night and shadow—or were those high-flung excrescences shifting and changing shape?

They were shifting arches and domes, turrets and spires were melting in ferment, like lightning-threaded, rolling edges of the thunder-cloud!

I wrenched my gaze away. Our platform had come to rest upon a broad and silvery ledge close to the curving frame of the portal, and near us stood Norhala, arms clasped about the rigid form of Ruth.

Before one of us could find tongue to cry out, the cube glided to the edge of the shelf, and dipped out of sight.

That upon which we rode trembled, and sped after it.

There came a sickening sense of falling. We lurched against each other. For the first time the pony whinnied, fearfully. Then we were flying down a wide and steeply angled ramp—into the Pit, straight toward the half-hidden, soaring, escarpments flashing afar.

Far ahead raced the woman and the maid. Their tresses streamed, mingled, silken web of brown and shining veil of red gold. Little clouds of sparkling corpuscles threaded them, like flitting swarms of fireflies. Their bodies were nimbused with tiny, flickering tongues of lavender flame.

About us, above us, began again to rumble the countless drums of the thunder.

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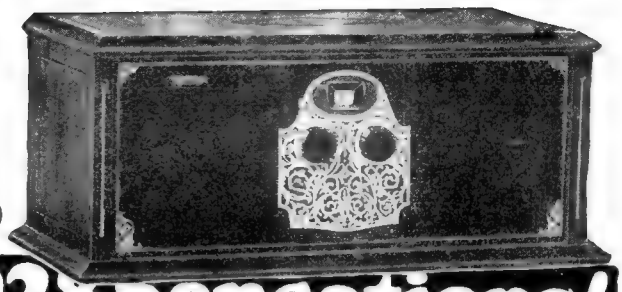

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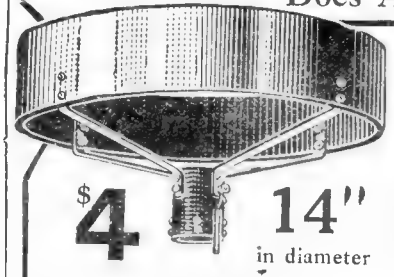

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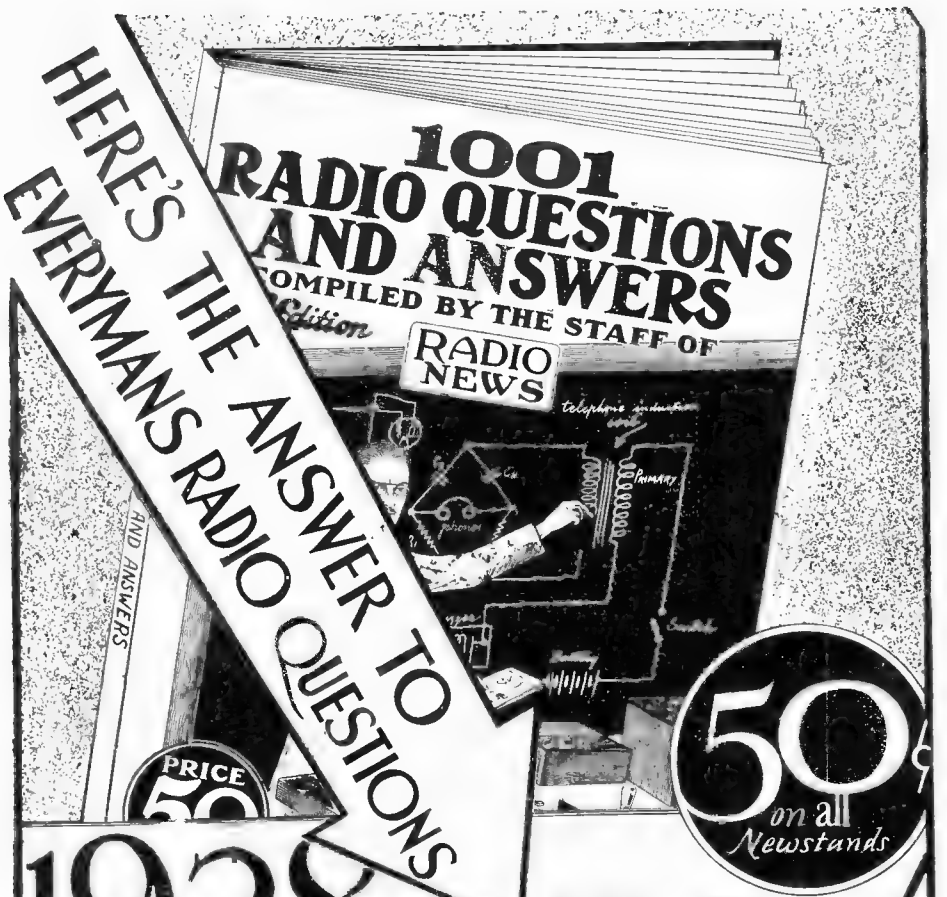
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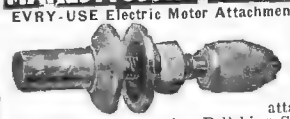

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CHAPTER XI

THE PORTAL OF FLAME

IT was as though we were upon a meteor hurtling through space. The split air shrieked and shrilled. The blast bent us far back on thighs held rigid by the magnetic grip. The pony spread its legs, and dropped its head. I watched Ventnor crouch lower and lower, eyes shielded behind arms folded over his brows, straining for glimpse of Ruth; saw Drake crouching beside him, bracing him, supporting him, bent against the tempest.

I twisted, dropped upon my right arm, thrust my head against my shoulder, and looked backward. When first I had looked upon the place I had sensed its immensity; now I began to realize how vast it must be—for already the portal through which we had come glimmered far away, dwindling fast.

I became sensible of a diminution of the cyclonic force. I turned my head, cautiously.

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Upon the very edge of the flying blocks squatted Drake and Ventnor, grotesquely frog-like. I crawled toward them—crawled, literally, like a caterpillar, for wherever my body touched the surface of the cubes the attracting force held it and allowed a creeping movement only, surface sliding upon surface.

As my bare palms clung to the things I realized with finality that whatever their activation, their life, they were metal.

There was no mistaking the testimony of touch. Metal they were, with a hint upon contact of highly polished platinum, or, at the least, of a metal as finely grained as it. Also they had temperature, a curiously pleasant warmth. The surfaces were, I judged, around ninety degrees Fahrenheit. I looked deep down into the little sparkling points. They were like the points of contact of innumerable intersecting crystal planes. They

held a paradoxical suggestion of being close to the surface, yet infinite distances away.

And they were like—what was it they were like?

It came to me with distinct shock that they were like the galaxies of little aureate and sapphire stars in the clear gray of Norhala's eyes!

I crept beside Drake and struck him with my head. He looked down at me.

"Can't move," I shouted. "Can't lift my hands. Stuck fast—like a fly—"

"Drag 'em over your knees," he cried, bending to me. "It slides them out of the attraction."

Acting as he had suggested I found that I could slip my hands free. I caught his belt, and tried to lift myself by it.

"No use, Prof," a grin lighted his tense face, "you'll have to keep praying till the power's turned off. Nothing here you can slide your knees up on."

I sank back on my haunches to relieve the strain upon aching leg-muscles.

"Can you see her ahead, Thornton—Ruth?" Ventnor turned his anxious eyes toward me.

I shook my head. I could see nothing. It was, indeed, as though the clustered cubes sped within a bubble of the wanly glistening vapors; or rather as though in our passage, as a projectile does in air, we piled before us a thick wave of the mists which, streaming along each side and closing in behind, obscured all that lay around.

Yet, I had, persistently, the feeling that beyond these shroudings was vast and ordered movement. Myriads of feet of creatures of an unknown world marking time just outside the threshold of our own.

Drake and Ventnor straightened up. I raised myself to my own aching knees.

We were at one end of a vortex, a funneling within the radiant vapors; a funnel whose further end, a mile ahead, broadened out into a huge circle, its mistily outlined edges impinging upon the towering scarp of the city. It was as though before us lay a crystalline cone against whose curved sides some radiant medium, heavier than air, lighter than water, pressed. The top arc of its prostrate base reached a thousand feet or more up the precipitous wall. Back from the curving sides of this cone, above it and below it, the pressing luminosities stretched, into, it seemed, infinite distances.

Through them, suddenly, thousands of bright beams began to dart, to dance, weaving and interweaving, shooting hither and yon—like myriads of searchlights in a phosphorescent sea fog, like countless lances of the aurora.

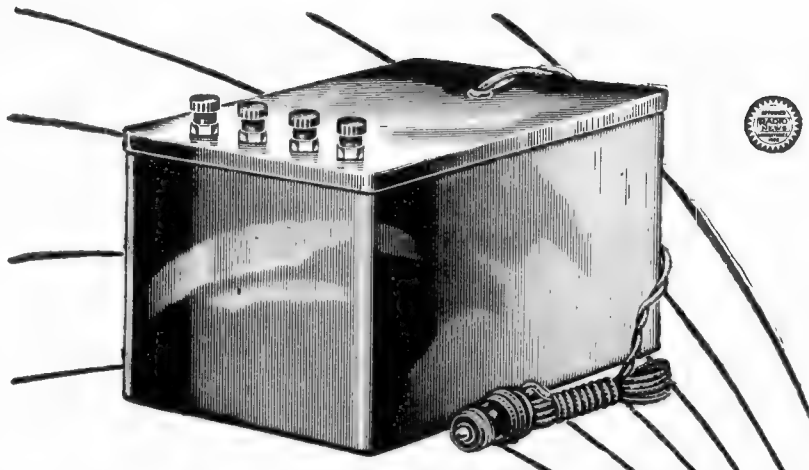
The rays sprang upward from the earth. Now they were countless lances of light borne by marching armies of Titans. Now they crossed and angled and flew as though they were clouds of javelins hurled by battling swarms of the Jinns of Light. And now they stood upright while through them, thrusting them aside, bending them, passed vast, vague shapes like mountains forming and dissolving, darkening monsters of some world of light pushing through thick forests of slender, high-reaching trees of cold flame, shifting shadows of monstrous chimeras slipping through jungles of bamboo with trunks of diamond fire, phantasmal leviathans swimming through brakes of giant reeds of radiance rising from the sparkling ooze of a sea of star-shine.

"Ruth!" groaned Ventnor. "Ruth! Where is she?"

The shining cone began to move. Slowly, the base slipped down the shimmering façade; down, steadily down.

Not ten yards ahead of us and still deep within the luminosity appeared the head of Norhala and the head of Ruth. The two rose out of the glow like swimmers floating from the depths.

But neither turned to us; each stared straight along the axis of the sinking cone.



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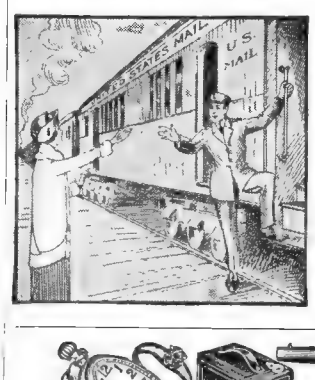

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the woman's right arm holding Ruth close to her side.

Drake's hand caught my shoulder in a grip that hurt—nor did he need to point. The funnel had broken from its slow falling. It had made one swift, startling drop and had come to rest. Its recumbent side flattened into a triangular plane, widening from the narrow tip in which we stood to where its base rested against the blue wall.

The misty-edged circle had become an oval, a flattened ellipse. In its exact center, shining as though it opened into a place of pale azure incandescence was a Cyclopean square gateway.

On each side of it, a slit was opening. They began as thin lines a hundred yards in height, through which the light seemed to hiss. Quickly they opened—widening like monstrous cat pupils until at last their widening ceased, and they glared forth, the blue incandescence gushing from them like molten steel from an opened sluice.

Deep within them began a movement. Scores of towering shapes whirled within them. These glided out—score upon score of obelisked shapes.

They rushed forth, wheeling like dervishes, driving like leaves in a whirlwind. Out they swirled from the cat's eyes of the glimmering wall—dervish obelisks crowned with spinning fires, and vanished in the mist. Instantly, the openings contracted; were but slits; were gone. Within the oval was only the great gateway.

The leading block leaped forward and rushed down the steep. Those that bore us followed. Again, under the strain of projectile flight, we clutched each other, and the pony screamed its terror. The metal cliff rushed to meet us like a thunder cloud of steel. The portal raced upon us—a square mouth of cold blue flame.

Into it we swept. We were devoured by it. Light in a blinding, intolerable flood beat about us.

(To be continued)
(Second Serial Rights)

Articles in December "Radio News"

The Peridyne Five—By Hugo Gernsback.

260,000 Good Customers Waiting for Radio —By Armstrong Perry.

The Super-Hilodyne Receiver—By Fred A. Jewell.

The Fourth Annual Radio World's Fair.

Golden Opportunities of Custom Set Builders—By Earl Sowers.

A Conveniently Adjustable "B" Power Unit—By Joseph Riley.

Broadcast Listeners' Section.

SHORTER DAYS, BIGGER LIGHT BILLS

The size of the bill will vary month by month, in direct proportion to the number of hours artificial illumination is necessary.

Statisticians in the electrical industry have figured out the average number of hours a day that artificial light is needed approximately as follows:

January	6.35
February	5.38
March	4.10
April	3.48
May	2.95
June	2.55
July	2.66
August	4.00
September	4.45
October	4.90
November	6.18
December	6.85

—Courtesy N. E. L. A.

Reader's Forum

(*Continued from page 721*)

made the proposition seem absurd—and this is why: Granting that the crystal itself lost all or most all of its weight, if placed in mid-air it would stay there, because weight is the measure of the force of gravity on a body, and a body with no weight would have no gravitational pull exerted upon it. There are, however, several possibilities of a body being without weight, one is if a body is situated in the exact center of the earth, the other is if a body is situated approximately 160,000 miles from the earth. In the latter case for example, a bucket of water could not be emptied, for there would be theoretically no "up" nor "down". Now in the case of the quartz crystal proposition, a fifty-five pound weight was apparently standing in mid-air connected to the quartz, but the point is that even assuming that the crystal possessed no weight, the weight of the fifty-five pound body would draw it down to the surface of the table, being physically tied to it. It is possible, however, to have a steel or iron bar stand in mid-air if two permanent magnets are correctly spaced from it, but this phenomena is due to magnetic effects, that apparently nullify gravity, for the iron itself doesn't lose its weight.

JOHN HENRY MEREDITH,
New Haven, Conn.

(You are certainly to be congratulated on your clear thinking and on your ability to analyze statements made in even a scientific publication, unless they are proven. To paraphrase the old saying "An occasional hoax now and then is relished by the best of men." There are altogether too many hoaxes being perpetrated today to warrant acceptance without investigation.—EDITOR.)

THE GRAVITATION HOAX—GOOD

Editor, SCIENCE AND INVENTION:

Your gravitation hoax was a good one. I once wondered why people believed the Moon Hoax. I know why now!

Being an amateur photographer I should have known what an old German telephone transmitter looked like, thought the microphone was a coil, never saw the headphones, until they were pointed out to me, and missed the fact that the wire loop was not taut around the weight ring.

Verily, man is a credulous critter.

GLENN D. RABUCK,
Ames, Iowa.

(The above letter is just merely one example of the very many which we receive, indicating that the readers really believe that gravity had at last been defied. We admire the writers for their acknowledgment of having been fooled by what appeared to be an authentic case of nullifying gravity, but which did not bear investigation.—EDITOR.)

HE ALSO WAS FOOLED

Editor, SCIENCE AND INVENTION:

In regard to the Gravity Nullification Hoax published in the September issue, I must admit that I believed it. However, the main illustration looked strange to me (rather like a haphazard collection of junk) and I wondered why the high frequency oscillator was "omitted for clearness". I had considered gravity nullification as a novel experiment for our class of Physics.

I think you made a mistake in using the Hoax as subject for a cover illustration. It was certainly misleading. I fear I shall expect to find all your articles to be hoaxes for some time to come. My confidence in you is shaken. I excuse my gullibility on the grounds of youth, being fifteen years old.

On page 394 of the September issue you carried an article entitled, "To The Moon Via Tunnel". How, I wonder, would the travelers in space alight safely upon returning to the earth?

You are to be congratulated upon abolishing Wirekraft and Matchcraft.

You are to be congratulated again upon your selection of A. Merritt's "The Metal Emperor" as a scientifiction tale. It is doubly welcome following "The Radio Séance," in which I was unable to find any trace of science.

EARLE MILLER,
Eaton Rapids, Mich.

(We regret very much that your confidence in us has been shaken, but we can assure you that if we perpetrate any hoax whatsoever, we will not permit the error to remain without exposing it. There is no reason why people flying in space could not return to the earth by the same means of locomotion, which they used in leaving this Earth's gravitational pull. By the aid of rockets, any interplanetary vessel could be steered.—EDITOR.)

A FEW SUGGESTIONS

Editor, SCIENCE AND INVENTION:

Having been a reader of your magazines—SCIENCE AND INVENTION, AMAZING STORIES, and THE EXPERIMENTER (in its day), I decided to pass a few remarks regarding them.

Amazing New Glass Cleaner offers $15 a Day PROFIT!

HERE'S an absolutely new, money-making proposition that will bring you big profits—*easy profits*—QUICK PROFITS! You can make $50 a week in spare time—$100 in full time—taking orders for JIFFY GLASS CLEANER—a new, pure, harmless liquid that easily and instantly cleans glass surfaces without water, soap or chamois. Think of it! Unequaled for cleaning windows, mirrors, windshields, show cases, eyeglasses, etc.

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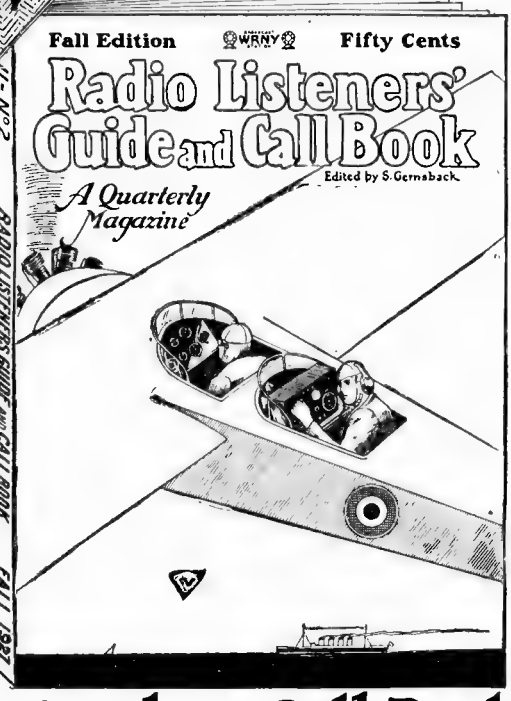

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On the whole, they are excellent with the exception of two faults (which have been brought before your attention by a number of other readers) the *name "Amazing"* Stories, and the inclusion of radio articles in SCIENCE AND INVENTION. The introduction of "What Do You Know?" doubles the value of AMAZING STORIES—why not print it on the front cover or inside on the front page where it will be noticed first thing. Also, if your "vote of preference" was printed on a page with advertisements on the other side it could be used without spoiling the magazine for another person or a rereading. If this principle, in fact, could be applied throughout SCIENCE AND INVENTION, those who do not wish to fill up space with a lot of unwanted material could cut out the desired articles without spoiling others—for example—to cut out the chemistry section usually means ruining the electrical.

In SCIENCE AND INVENTION more articles on high frequency electricity (the building of such coils and their uses for example) microscopy, and chemical tests would be very interesting. I don't believe you ever published any articles on trick photograph, etc.

Referring to the letter by D. M. Hough of Chicago, in July issue of SCIENCE AND INVENTION, I would like to mention that an old book, published about 1904 (?) entitled, "The Dissociation of a Personality", by Dr. Morton Prince. This ought to be very interesting and instructive to those interested in that subject.

W. R. SETTLE,
Edmonton, Alta., Canada.

(Quite a few years ago, SCIENCE AND INVENTION Magazine ran a contest on double exposure photography and trick photography. For some reason or other, it did not appeal to the majority of readers. While we realize that it would be bad, from many of the readers' standpoint, to publish an article on each alternate page of SCIENCE AND INVENTION, there are many who would not prefer this system. Of course, such an arrangement would enable a magazine to be cut up and pasted into a book without destroying other articles. The best possible way of doing so with the present arrangement is to secure two copies of the magazine and tear the pages out, pasting them down as desired. In this way the complete article will always be on hand. —EDITOR.)

A ROCKET IN SPACE

Editor, SCIENCE AND INVENTION:

You say that you receive thousands of designs of perpetual motion devices. Now, Mr. Editor, don't you think it would be a good idea to publish some of these devices in your magazine? This might save many dollars to inventors who are working on perpetual motion machines, but do not know that the device they are working on has been tried out by hundreds of other inventors and proved a failure.

I'm reading an article in your magazine on how it is possible to send a rocket to the moon. I think that you or whoever wrote that article, has overlooked one thing and maybe two. First, that sending a rocket from the earth into the space of absolute zero, which is 273° below zero, would cause the rocket to burst into microscopic particles before it would reach a height of 200 miles above the earth, inasmuch as the pores of the rocket material would have to adjust themselves to absolute zero. With a rocket traveling at such a speed, it would be impossible for the pores to change. I may be mistaken. On the other hand, there may not be an area of absolute zero. Scientists tell us that the earth does not get even one thousandth of the heat that is directed to the earth through space. Perhaps it is so hot that the heat would turn the rocket into smoke.

STEVE WARMECKY,
Indianapolis, Ind.

(We have on several occasions published some of the more difficultly analyzed perpetual motion devices in SCIENCE AND INVENTION Magazine. On the whole, most of the perpetual motion mechanisms follow a certain set order of rules or else a certain fixed number of styles. These styles are quite clearly explained in Percy Verance's book called, "Perpetual Motion." This book, if read and carefully considered, will be the means of saving many dollars on ridiculous combinations of machinery, but the difficulty is that most perpetual motion inventors believe they can surmount all difficulties of previous inventors in the same fields.

There is no reason why a rocket going to the moon should burst into microscopic particles because it is at a temperature of —273° below zero. While it is true that gases at this temperature would not continue to exist, it does not necessarily mean that other objects would go out of existence. There is much interstellar dust and there are many satellites in that space of —273°, and these satellites do not burst nor does the dust vanish into nothingness—an inconceivable state.—EDITOR.)

PLAGIARISM

Editor, SCIENCE AND INVENTION:

Our attention has been drawn to an article appearing on page 518 of the October number of your publication SCIENCE AND INVENTION. The design of a Cigarette Field Gun has been copied in detail from one of our copyright designs issued by us some time ago. We enclose cutting taken from our catalog in which this design is illustrated.

We are quite sure that with a publication of such high repute as yours, that this design would not be inserted without asknowledgement to us had you known from whence the idea had been taken. We think, however, that you will wish to very strongly write to your contributor, Mr. J. E. Lovett, who has presumably submitted this article as an original one of his own.

R. M. Thomas,
Handicrafts, Ltd.,
London, England.

(You are perfectly correct in assuming that had we known the existence of the design of a cigarette field gun, the article would not have appeared in SCIENCE AND INVENTION Magazine without credit to the designers. It is impossible for the editor to know everything that has been published and we always thank our readers for pointing out any sign of plagiarism. It may be that Mr. Lovett himself did not know of the existence of the design, having probably purchased one of these guns and made the illustration from the purchased product or perhaps he obtained it as a present from some friend who claimed the idea as original. We always like to give our writers the benefit of the doubt. On the other hand, we do not countenance plagiarism.

We are certainly pleased to here insert the credit for the design.—EDITOR.)

FILTERED LIQUID AIR

Editor, Science and Invention:

I am taking the liberty of asking a question. One cannot experiment with little or no apparatus and if you cannot answer my query, you may experiment or refer the question to someone else.

What power of magnification would filtered liquid air have, when contained or circulating within a thermos tube, the tube possessing curved glasses at its ends? Some such method might conceivably greatly extend our vision in astronomy. I understand that the "evening star" appears larger because its light passes through more of the earth's atmosphere. I understand that filtered liquid air appears bluish in color and it may be necessary to neutralize same.

Any comment or advice will be very much appreciated.

I enjoy Science and Invention hugely.

Mark L. Franklin,
Owen Sound, Ont., Canada.

(We do not believe that filtered liquid air would give a very great magnification factor. This would depend largely on the shape of the lens and its size. The difficulties in making two curved pieces of glass to hold the liquid air would be just as manifest as if the same glass were used for a telescopic lens. Filling the space between the two walls with liquid air would cause the glass to become very cold and would cause the moisture of the air to condense thereon, producing a surface coating of white frost, detrimental to subsequent use. The internal pressure would likewise be quite great and the liquid air, due to its unstable state, might boil vigorously within the confining walls. Any other transparent medium might be used instead of liquid air with practically the same results. We believe that the system outlined would be of no particular value to astronomy.

A new telescope with a lens 300 inches in diameter is about to be built. You can read all about it in this issue of this magazine.—EDITOR.)

TRANSMITTING VIBRATIONS

Editor, Science and Invention:

I certainly think your July number is a wonderful improvement over the June one. It seemed to me that you were publishing less science every month until at last the June issue contained more Wire, Matchcraft and Departments than scientific articles. However, the July is a "peach" and there are few articles to be criticized. Personally, I think "New Devices of the Month", "Magic", "Home Mechanics" and "Motor Hints" could be left out and other real scientific subjects discussed. Now so you will not think I'm a crank, I'll tell you what to keep in your magazine at all costs. First, is the editorial; second, the story; third, "Experimental Chemistry"; fourth, "Experimental Electrics"; fifth, "The Constructor"; sixth, "How To Make It"; seventh, "Wrinkles"; and eighth, "Radio". By the way, it seems in the July issue you forgot "The Junior Electrician", a fine article! Also, for the life of me, I cannot count forty radio articles.

Now that I have told you what I think of your fine magazine, I would like to open a new topic for discussion in the Readers Forum. That is, the possibilities of transmitting by radio solid substances. My ideas on the subject started from the July Amazing Stories (another "peach") where in the story "Radio Mates" the author briefly described a means of transmitting solids. He says a wooden ball was dissolved into its vibrations and these transmitted into the ether by radio waves. I do not fully understand the idea of dissolving it into its vibrations and I would appreciate (if this letter is published) that someone attempt to describe in the Readers Forum their interpretation of that phrase. Again if humans were transmitted, what would become of our soul which everyone is supposed to possess and is in no material form as far as we know? People declare criminals and murderers as soulless beings; what then would humans be like if they were transmitted over some sort of device for that purpose?

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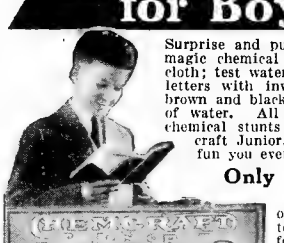

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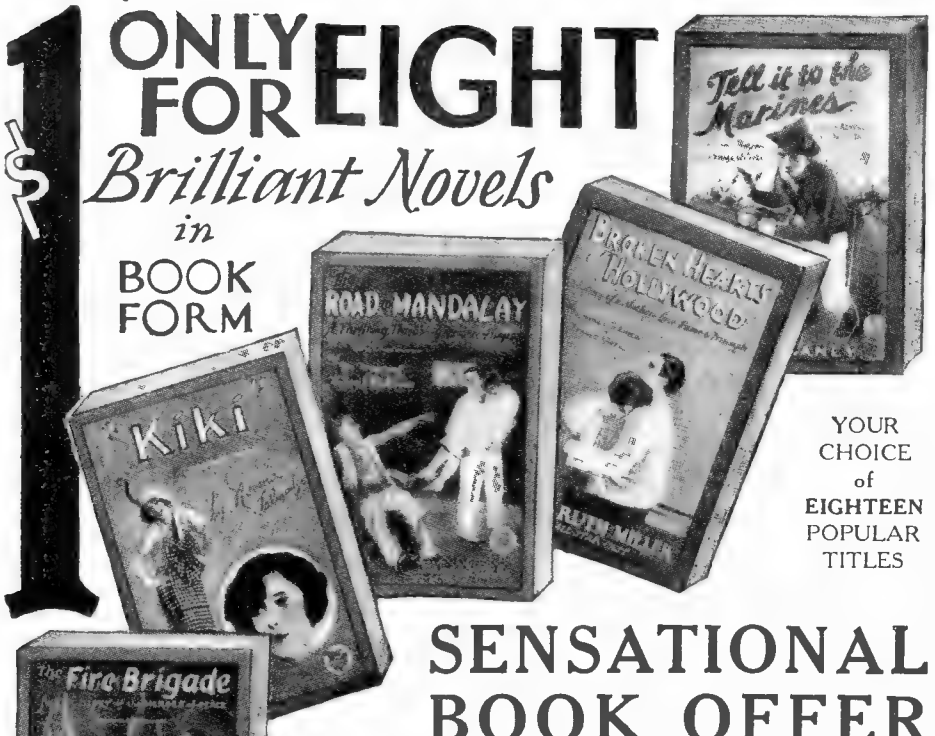

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Hands Create Radio Music

By H. WINFIELD SECOR

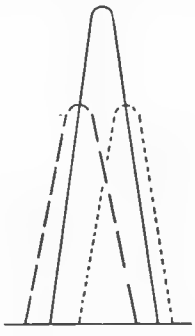
(*Continued from page* 694)

In studying the diagram shown on page 694, it should be remembered that when the brass rod and circle are used, together with variations in body capacity, caused by moving the hands in proximity to the metal electrodes, that the usual variable condenser connected across the main oscillator inductance, is dispensed with. In other words, the body capacity takes the place of the electrical capacity usually supplied by the metal plate condenser, connected across grid and filament of the oscillator tube.

It should be noted that when the right hand, for instance, is moved toward or away from the circle electrode, that variations in the volume of the music are obtained; when the left hand, for instance, is moved toward or away from the straight rod electrode, which is connected to the grid side of the oscillator circuit, changes in the pitch of the musical tone are obtained. This is important to remember in carrying on any experiments with this apparatus. For those interested in experimenting with a "vacuum tube organ," as we might call it, the writer would suggest that they read the article by Mr. Clyde Fitch, describing Mr. Hugo Gernsback's "Pianorad," which appears in the November-December 1926 issues of RADIO NEWS.

In the simple musical audion circuit shown on page 694, and which is similar to

HETERODYNE PRINCIPLE



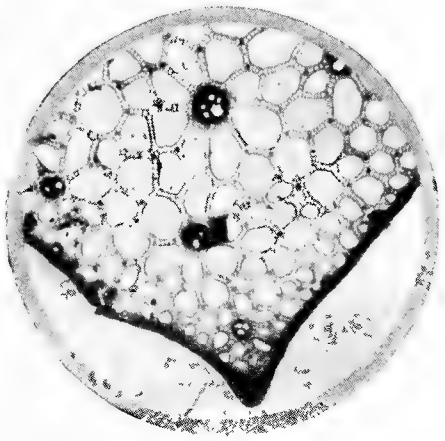
———INCOMING SIGNAL
-------OSCILLATOR FREQUENCY
———RESULTING FREQUENCY

The diagram above shows the action taking place when one current is super-imposed upon another, giving rise to a third or resultant frequency, as indicated by the full line curve.

that used in building the "Pianorad," described one year ago in our sister publication, RADIO NEWS, as aforementioned, it will be found that quite large inductances, in the form of honeycomb coils, are necessary to produce the difference frequencies necessary for the average scale of musical notes. With the more elaborate, yet really quite simple, heterodyne circuit shown in the larger diagram on page 694, it becomes possible to produce a considerable range of musical notes without using extra large inductances, due to the peculiar operation of this form of circuit. Referring to the diagram on this page, which shows the heterodyne principle on which the action of Prof. Theremin's instrument is based, we perceive how it is that a new or resultant frequency is produced, whenever two slightly differing frequencies are super-imposed one upon the other. This is the action taking place in the super-heterodyne receiving set, with which most radio fans are more or less familiar. If the incoming signal has a fixed frequency, any changes in the oscillator frequency will cause a change in the resultant frequency, and vice versa.

Microscopical Instruments from Toy Constructor Parts

(*Continued from page 719*)



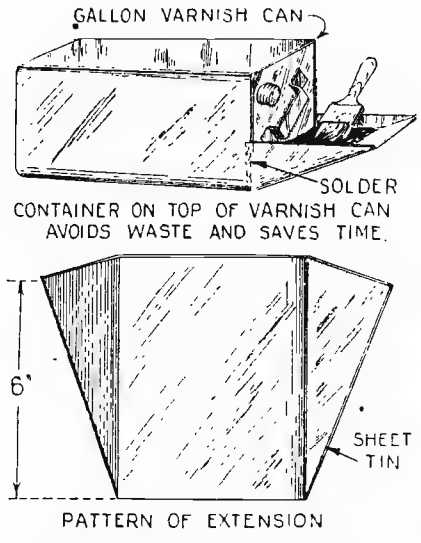
A section of the bulrush magnified 25 diameters cut with the slicing machine described and photographed with the camera as shown in previous illustration.

lens mounted some distance from the first. This is not absolutely essential but if present gives better illumination. Then comes the slide holder which consists of two strips so mounted that they exert a slight pressure on the slide and hold it firmly. Last comes the objective of low power. This is arranged so that the end that was in the tubular of the microscope points outward toward the screen. This last holder for the objective should be mounted in such a way that it is movable and may be focused on the slide. A battery or toy transformer gives the necessary six volts to run the light and an image a yard in diameter or even larger may be readily obtained. The magnification depends on the magnifying power of the objective and the distance from the objective to the wall.

—*Contributed by Dr. Ernest Bade.*

Hints for the Mechanic

(*Continued from page 719*)



A container soldered to the top of a varnish can as shown above will avoid waste.—G. L.

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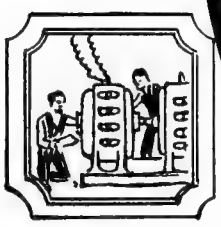

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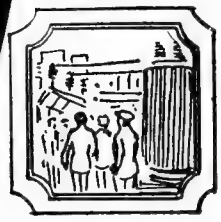

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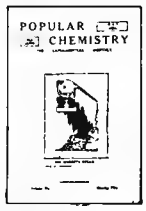

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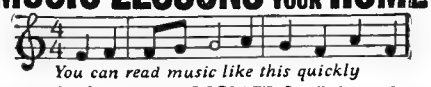
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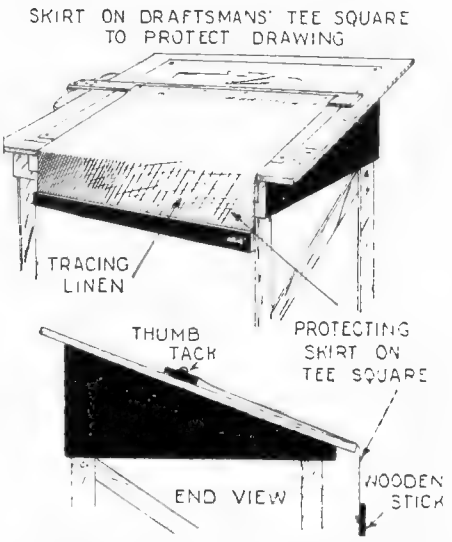
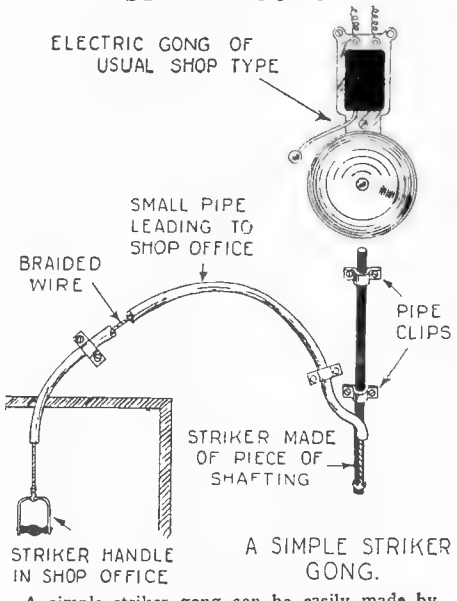


A piece of tracing linen affixed to the T square as shown above will protect the drawing.

STRIKER GONG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STRIKER MADE OF PIECE OF SHAFTING
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A simple striker gong can be easily made by following the suggestions given above.

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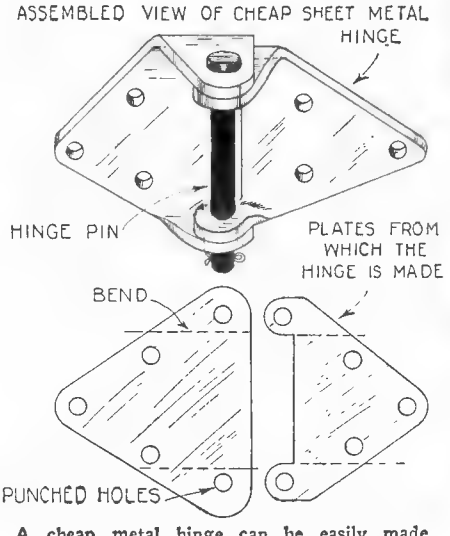

A cheap metal hinge can be easily made from two plates which have been cut from a piece of sheet metal. The plates are made in the shape as shown above and holes punched therein for mounting. A hinge pin holds them together.

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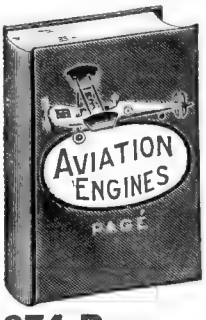

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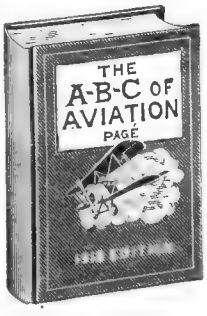

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(*Continued from page* 701)

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I have the layman's viewpoint and am willing to seek the tolerance of scientific minds in what I might say upon this subject. In order to gain a wide knowledge of any problem and speak more or less intelligently of it, one should make a thorough exploration before attempting to offer a solution and should always keep his mind open and free from bias. One who went up into Canada, for instance, to visit friends for a few weeks, say at Parry Sound, should not come back home and attempt to tell his neighbors all about Canada. The same holds true of one who might visit Los Angeles only for one Winter and come back full of knowledge concerning the entire State of California.

The scientific mind is bound to decide any question solely from the standpoint of science based upon the progress made up to the time of its

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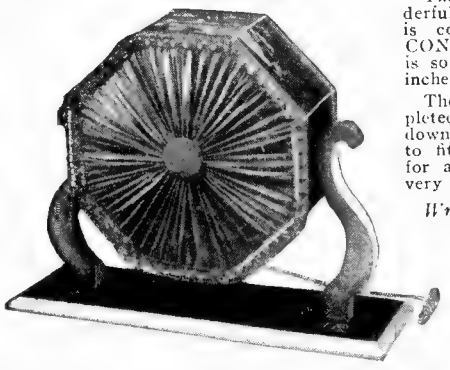

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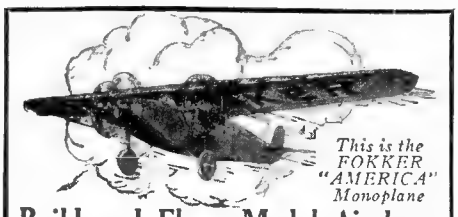

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analysis. However, the progress of science must go on and no restrictions should be placed by fair minded persons in any walk of life upon the development and experimentation of methods that have for their sincere purpose the alleviation of chronic disease conditions. Theories should not be condemned without full investigation and in the case of the I-ON-A-CO I do not believe that justice could be done the public or the appliance itself unless a fair measure of consideration were given the voluntary statements of the thousands who claim to have been benefited. If a person is not to be permitted to study his own condition and express himself upon it without ridicule from those who set themselves up as supreme judges affecting his case, there is only one alternative and that is to surrender ourselves completely to medical and scientific minds that are admittedly circumscribed by the progress or lack of progress in medical science up to the present moment.

If I were to say to you that I personally am able to instantly control an attack of lumbago in my own person by the regular use of the I-ON-A-CO, adding that I know something about lumbago since for years I have had recurrent attacks, you would, in being consistent with the attitude expressed in your article, say that I was only "kidding" myself and was not intelligent enough to decide whether or not I had lumbago in the first place, or whether having had it, it had left me. This, however, is my story, and all the medical and scientific men in the world cannot change it in so far as I personally am concerned.

I would like to say just a word concerning my policy in presenting the I-ON-A-CO to the public. We invite people to come freely and make use of the I-ON-A-CO in our office without any obligation whatsoever. We explain the theory and scientific precedent upon which the theory is based, and allow the patient to decide absolutely for himself whether he cares to continue using the I-ON-A-CO. Generally they decide that they are being benefited and take one home. Almost immediately inquiries come in from friends to whose attention the I-ON-A-CO has been brought by patients. Thus an endless chain is established and the story becomes one of personal individual results in the person of the one using the I-ON-A-CO. We consider our policy highly ethical and proper in every respect.

Again thanking you for your courtesy, and assuring you that I thoroughly enjoy hearing from the *lips of our patients their stories of relief*, I am,

Very truly yours,
W. T. Yearsley,
Wilshire's Ionaco,
Chicago, Ill.

P. S. While unimportant, you may be interested in learning that the Seattle Union Record began carrying Wilshire's I-ON-A-CO advertising last May. Draw your own conclusions.—WTY.

(Unfortunately, the Ionaco method of treatment is not based on any scientific theory. While it is true that attempts are made to place a scientific aspect on the system, a dyed-in-the-wool scientist finds the explanation untenable. The same is true of the electronic reactions of Abrams. From points of theory, it is wonderful to behold. Dr. Abrams likewise had a great number of followers who claimed to have been benefited by his method of treatment. The same story holds for many other swindles such as the Oxygenator, the Oxygenor, the Electropoise, the Oxydonor, the Oxypathor, the Oxytonor and the Oxybon, small metallic tubes, generally containing coke dust, about 3½ inches long and connected with one or two cords. The manufacturers of these articles receive thousands of testimonial letters, yet the apparatus are worthless.—EDITOR.)

DR. HARDING'S IRON-IZER

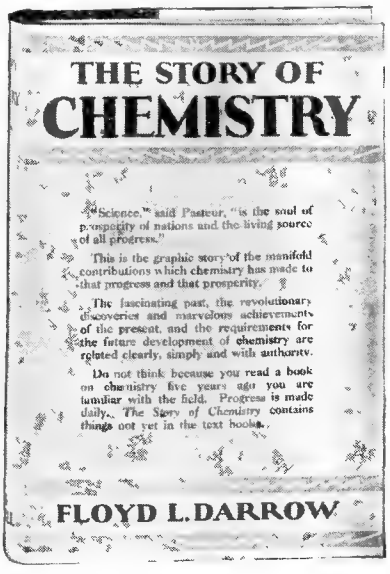
Editor, Science and Invention:

I was especially interested in your article entitled, "The Ionaco Swindle," appearing in the October issue of Science and Invention, in that I was instrumental in persuading a friend to discard magnetism as dispensed by the Ionaco in treating T. B. I feel that I was benefited by reading the article and hope that many others were reached. I am enclosing a booklet in which you may be interested. I can see no difference in this apparatus and that treated so splendidly in your article. As I learned only this evening about the Iron-izer, I have not had a chance to see the representatives. However, I intend to call upon them tomorrow morning and learn how this marvelous device operates and the cures (?) already effected. I also intend to call upon a friend who is a member of the Better Business Bureau of this city, as well as a member of high influence in the Chamber of Commerce. I will take one of these pamphlets with me; also your article, so there may be another good health producer fall by the roadside in a few days.

I wish to comment upon Science and Invention at this time. I cannot criticize as I myself have made no contribution to the columns, but I liked the magazine better about fifteen years ago than I do now, although it is still very good and I would not miss an issue. The contributors are very good and I read every word eagerly. At present I am covering an invention, still in the Patent Office, which should be of interest to nearly every reader. As soon as the patent has been granted, the article will be released, which you may publish if you see fit.

Allen Lamm,
Shawnee, Okla.

(It seems to us from the description in the booklet, that Dr. Harding's Iron-izer is quite identical with the Ionaco apparatus described in the October issue of SCIENCE AND INVENTION Mag-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azine. Not as yet having dissected this apparatus, it would be impossible for us to tell whether it contains the same number of turns of wire or whether copper wire is employed in the apparatus but the cover looks the same, the action reads the same, the testimonials cover similar diseases and the apparatus is worn in the same manner as the Ionaco. The foundation on Dr. Warburg's work is the basis for both pieces of apparatus. By no great stretch of the imagination one might assert that the articles for treatment are identical. —EDITOR.)

THE RESTORO

Editor, SCIENCE AND INVENTION:

I "feed" on SCIENCE AND INVENTION every month, year in and year out. The Ionaco article by your Mr. Gernsback in your October issue leads me to believe that you would be interested in the enclosed correspondence I had with a similar concern, and I feel confident that you will be glad to return this literature to me after you have done whatever you care to do with it, (excepting, of course, to use my name.)

The radio was used from one of the big broadcasting stations in Chicago, to advertise this device, and one of the smoothest, most convincing talkers I ever heard, told of the wonderful results obtainable through the use of this "Magnetic Circle."

It was from hearing this radio talk that I wrote to these Chicago people, inquiring for further details of their apparatus and their startling statements in their follow-up letter of July 15th are along the same lines as set forth in your article.

The names Ionaco and Restoro bear a certain similarity in a way, especially in the last syllable, (always ending with an "o") which would lead one to believe that all of these trade names are invented by the same head swindler and that there is probably a connection between these two in particular and probably many others throughout the country under different titles. It would be interesting to investigate merely along this line alone and see if, in the East, West, North and South of these United States, there can be found a similar fraud with a trade-name of a similar ending: "A-co" or "Oro" or some other "O" such as "Neuro." If such an investigation should confirm this suggestion, it would seem that one brain is directing it all and that said brain is running a big swindling company in the U. S., probably preying on the poorer, less intellectual class (the class that depends on manual labor for existence) and becoming fabulously rich by so doing.

It is surely an outrage against our people and I will gladly hand you any information I can find anywhere and anytime, of any fraud that I hear of in hopes you will write it up as you have done in this case.

H. M.

(It would seem that it is not one brain which is operating the various organizations making magnetic circles, but rather that due to the fact that the Ionaco is able to mulct sufferers to the tune of $58.50 for an article costing $5.75, other individuals, quick to grasp the money-making possibilities, duplicate the apparatus. The only difference that we can see between the Ionaco and the Restoro is one of price, the latter costs $8.50 less than the former.—EDITOR.)

THE FARADOR

Editor, SCIENCE AND INVENTION:

In your October issue, on the Ionaco Swindle, you ask to know of any other such schemes. I am enclosing a folder of the Farador Co. You would be surprised at what they can cure; anything from corns to T. B. It might pay you to write for information.

I am an electrical engineer, and it was quite amusing to me.

M. D. SPENSE,
Hamilton, Ohio

(We should hope it would be amusing to any engineer. It is not necessary to write for information on the Farador. The Farador is practically identical with the old Oxydonor, Oxypathor, Oxygenor, Oxygenator, Electropoise, Oxytonor, Oxybon and those various other frauds which were supposed to extract oxygen from water and do all sorts of ridiculous things. There is no claim made in the folder which you have forwarded us as to how the Farador works and we are this day writing to the organization for further information.

We wish to thank you very much for furnishing us with the lead, as we had believed that these organizations were out of existence long ago. We certainly do not advocate that you apply for one of these "Royal Road To Health." They certainly will not enable you to recover your health.—EDITOR.)

THE ABRAMS MACHINE

Editor, SCIENCE AND INVENTION:

Having been a reader of all your publications since the first issue of Modern Electrics back in the early days, and all those of today, I take the liberty of writing you on a little matter upon which I would like to be enlightened.

The subject is the Abrams method of treating diseases and supplying missing radio-active substances to the human diseased body. Having been an experimenter for the past twenty years myself, I have just been thinking over the matter as I saw it described in a circular telling about the Abrams machine. It seems to me that as it now stands it proves nothing definite and so out of curiosity and

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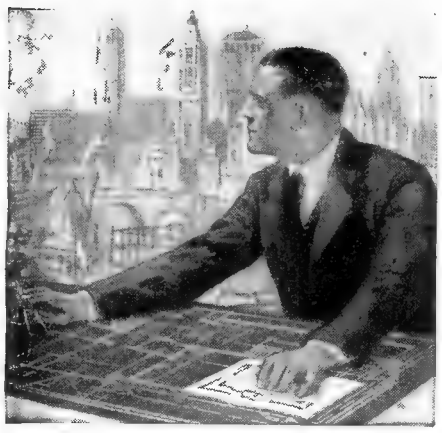

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a desire to learn more about the marvelous powers attributed to the oscilloclast, and means of detection used to signify the amount of treatment necessary, after discovering that the patient has the disease diagnosed.

J. R. Jordan, Jr.,
Chattanooga, Tenn.

(We also would like to know what the Abrams machine is all about. Several years ago, (before Dr. Abrams' death) SCIENCE AND INVENTION Magazine made an investigation into the Oscilloclast and likewise into the mechanism of Dr. Abrams. Following this investigation we came out with a flatfooted statement that while Dr. Abrams undoubtedly is earnestly trying to produce a mechanism which will cure diseases, his reasoning is not scientific and his mechanism on which he bases his arguments is far from that. We disclosed in detail the entire contents of the Abrams machine and made the assertion that the mechanism does not and cannot do what is claimed for it.

Subsequent to our investigation, the Scientific American took up an investigation of the same mechanism and after four months, came to the same conclusion, namely, that the Abrams machine is fraudulent. The American Medical Ass'n had already posted their opinion to that effect and with these three arguments in our favor, with no disciple of Abrams having, since his death, agreed to stand a scientific test, we entirely dismissed the matter. We recommend that you do the same. The Abrams mechanism is not based on proved scientific fact.—EDITOR.)

THE J. B. L. CASCADE

Editor, Science and Invention:

I just finished reading your article, The Ionaco Swindle, in the October Science and Invention.

Personally, I think you are doing a wonderful work in exposing these so-called "Fountains of Youth" as most people who buy such articles are of the poorer class and cannot afford regular treatment from a reliable doctor.

I am enclosing a letter and some literature which I received from the "Tyrrell's Hygienic Institute" in return for my name and address.

In your estimation, will this apparatus do all that they claim for it?

Do you think it worth the price of $12.00 complete?

Does it differ from the ordinary $3.00 syringe?

I am a regular reader of Science and Invention and think it the best 25c worth on the market.

Cecil Danner,
Norwood, Ohio.

(We certainly appreciate your confidence in us. The J. B. L. Cascade is well known in medical circles. The apparatus certainly will not do any more than an ordinary $3.00, or for that matter, $1.00 syringe. It is not worth the $12.00 which one pays for it.

The apparatus consists principally of a hot water bag, in the center of which one finds the syringe nozzle. The pressure for the water or watered medicament is obtained by sitting on the bag. Tyrrell's system then, is nothing more than one of irrigation.

For those individuals troubled with constipation, occasional irrigation is of undoubted value, but constipation should be corrected by diet rather than by irrigants. Adding plenty of vegetables and pulpy fruits to the diet will serve to remedy this condition to a greater extent.

It is a known fact that constant irrigation produces lassitude of the rectal muscles. The indiscriminate use of rectal enemas may be very dangerous to health. The apparatus, therefore, would certainly not be recommended by us as serving the purpose of anything else than a syringe, and a poor one at that.—EDITOR.)

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Light emitted by plants and animals, as well as that emitted by some inanimate substances when excited to luminescence, consists only of wavelengths that lie in the visible spectrum, whereas in all our methods of generating light only a few per cent of the total radiation emitted is of wave-lengths that are utilized in seeing. The remainder, which is from 95 to 99 per cent of the total, produces heat, but otherwise it is useless. If an animal were as wasteful its body would be desiccated by the heat produced when it emits light.

The light emitted ranges from a blue-green in the marine crustacean, to orange in the zinc vanadium sulphide and to a faintly-tinged greenish-white in the luminous wood.

—Dr. Coblentz.

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The Astrology Humbug

By JOSEPH H. KRAUS

(*Continued from page 708*)

Panama Canal
Central America
Opened Oct. 10th, 1913, 2 P. M. Eastern T.

At the official opening of the Canal, when President Wilson touched a button in Washington which set off a charge of explosives at Panama, the event was very appropriately "staged" with the explosive planet Herschel rising, in square to Mercury. Also Jupiter in opposition to Mars, was a very expansive influence. On November 10, 1927, Mercury will transit the face of the Sun, then coming to conjunction with Mars on the Meridian of this figure. This will start a lot of diplomatic talk over the status of the Canal, especially in connection with its possibilities for war purposes. November 15th to 18th, 1927, will be a critical time in such "conversations." For one thing it is likely that more money will have to be paid by the U. S. Government to Panama to settle certain claims of jurisdiction, etc. For regardless of cost (which will always be heavy, with Jupiter opposing Mars), the main purpose of the Canal must never be lost sight of, which is obviously a means of defense against possible aggression by a nation symbolized by the Sun, as Leo, ruled by the Sun is on the western horizon of this horoscope. The "rising Sun" is the symbol of Japan. These diplomatic troubles should be temporarily patched up by December 23, 1927, when Venus will be on the meridian of this horoscope. The year 1930 will be a very critical time in every way for the Canal; cave-in, and war.

Conference for Limitation of Arms
Opened at Washington, D. C.
Nov. 12, 1921, at 10:33 A. M. (Eastern T.)

When this conference opened, Venus and Mercury on the Meridian were quite typical of the eloquence used on behalf of peace. The intentions were mainly good. But Saturn conjunction Mars, both semi-square to the Sun (in the sign of Mars), were fair warning that too much could not be expected of this gathering. The rumbling of discord will always be heard approaching. The solar eclipse of June 29, 1927 occurred in Cancer 6°, right in opposition to the ascendant of this horoscope. That foreshows the beginning of the end of the understandings reached at this conference. On the evening of October 20, 1927, the Sun and Mars will be in conjunction on the Meridian of this figure. That will soon bring some disagreements to upset the peace gestures. Also, about October 31st, some foreign country will find some grievance to kick about, and November 23 will be a troublesome day for the diplomats. For Mars then transits the degree where the Sun was in the horoscope. About that time it will appear more the part of wisdom to go slow about scrapping our perfectly good warships, etc. . . . It all amounts to this; the Conference is nearing its end, and next year (1928) will be as dead as Pharaoh.

HAROLD CLIFT.

(Your idea of what constitutes a major event corresponds to our opinion. However, we do not consider that the predictions which you have made constitute what we would call exact predictions. For instance, you say that on December 24, 1927, King George will experience the truth of the old maxim that "troubles come in bunches." Perhaps what you believe are troubles will be of little consequence to King George. Likewise, what you consider to be serious trouble with foreign affairs may be nothing more than a few minor uprisings. While this matter might be serious to you, and more serious to those responsible for the uprisings, it would be of little consequence to either the British Empire or to these states. We certainly would not think that a prediction such as "October 9 will be a bad time," would constitute a definite prediction.

The letter from Mr. Auberlin which follows is, in our opinion, a style of prediction that is definite. There are no "perhaps," "talks," "critical times," "possibilities," or "likelys" in Auberlin's predictions.

We thought that the Arms Conference was a thing of the past; at least as far as the people of the United States are concerned, it is.—EDITOR.)

BASEBALL PREDICTIONS

Editor, SCIENCE AND INVENTION:

This letter was mailed on Saturday, Oct. 1, 1927, at the Berkeley Post Office, about 10:30 A. M.

It will be noted that Pittsburgh is leading St. Louis by two games, with both clubs having only two more games to play.

The following forecast is made covering the final results.

1. That Pittsburgh will lose their two remaining games to Cincinnati.
2. That St. Louis will win their two remaining games.
3. That St. Louis and Pittsburgh will be tied for first place.
4. That St. Louis will win from Pittsburgh in the play off.
5. That the first game of the Tie will be played on Oct. 4th, 1927.

Other forecasts covering World Series games is on record in my letters on file in your office.

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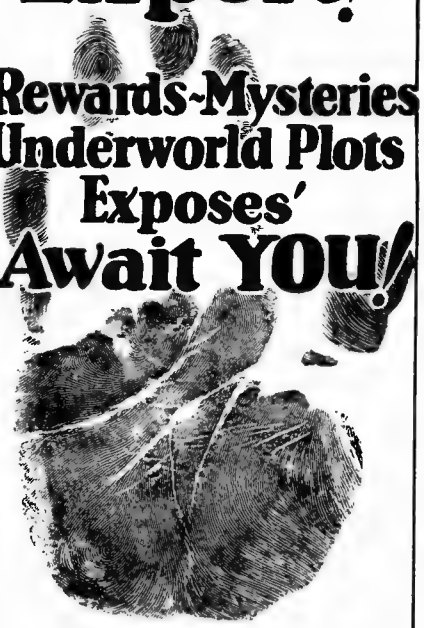

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Then, on Oct. 2, Mr. Auberlin sent the following letter:

The manifestation (t. t.?) observed on April 17, 1927, kept me from selecting Pittsburgh to win the 1927 National League Pennant. The significance of the letter C. and Y. observed on Oct. 4 and 5, 1926, representing the first letter of the nicknames of the clubs that would be the 1927 World Series contenders were fulfilled. Y, for Yanks; C, for Corsairs, see enclosed clipping, the letter C could be applied to the following clubs - Cincinnati, Chicago Cubs, St. Louis Cards and Pittsburgh Corsairs. The forecast on record in my letter of February 24, 1927, and September 20, 1927, are in effect, Pittsburgh of course taking the place of St. Louis in all of these forecasts. The following forecast is in force:

1. That the New York Americans will win the 1927 American League Pennant.

2. That the 1927 World Series will require seven games to decide.

3. That Pittsburgh will win the 1927 World Series.

4. That four games will be played in Pittsburgh, and three games in New York City.

5. That the total number of runs that will be made by both clubs in the first game of the Series will be four and that the Yanks will win from the Corsairs by the score of three to one.

6. That the total number of runs that will be made by both clubs in the second game of the Series will be five and that the Corsairs will win from the Yanks by the score of three to one.

7. That the total number of runs that will be made by both clubs in each game will be incorporated in the combination of totals obtainable from the numbers in both manifestations, 4.3.5.2 totals obtainable, 2.3.4.5.6.7.8.9.10.11.12. and 14. not obtainable 1. and 13.

8. That the greatest number of runs that will be made by both clubs in any one game will not be over 14. and that the lowest number of runs that will be made in any one game by both clubs will be more than 1.

9. That the total number of runs that will be made by both clubs in two separate contests, other than the first and second games will be 5. and 11. runs. Yanks 4, Corsairs 1. Corsairs 7, Yanks 4.

G. AUBERLIN,
Berkeley, Calif.

(While none of the predictions made by Mr. Auberlin are of a contradictory nature, their accuracy can be judged by the reader when he is presented with the facts. All the statements in the first letter are wrong. Here are the correct answers.

Pittsburgh won the two remaining games with Cincinnati.

St. Louis won one of the remaining games and the other was called off on account of rain.

There was no tie between St. Louis and Pittsburgh; consequently statement four is also incorrect and likewise statement 5.

Now let us look at his second letter.

The first statement made is right. 2. Only four games were needed to decide the World Series.

3. Wrong. The Yanks won the World Series.

4. Wrong. Only four games were played.

5. Wrong. The total number of runs in the first game was nine, the Yanks winning by a score of five to four

6. Wrong. The score of the second game being six to two in favor of the Yanks.

7. While this might be partly correct, the odds in favor of Mr. Auberlin are so great as to bar the record. The total scores were 33.

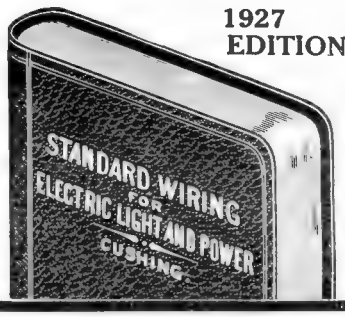
The writer of the above letter eliminated 1 and 13 as two possible scores which would not be obtained. This places the odds in his favor at 17 to 1. He might just as well have said 2 and 4 is not obtainable, or chosen any other two numbers from 1 to 33.

8. The same statement may be made and applied to this particular finding. Mr. Auberlin might well have used the statement that no team would score more than 20 runs. It is quite evident that a game could not be won with a score of zero to zero. Consequently, the figure 1, as being the lowest number of runs made in any game by both clubs could only have been more correct by quoting zero. Had Mr. Auberlin mentioned that the greatest number of runs in any game would be 9, his statement might have been a little more phenomenal. If he said that the fewest runs of both teams would be 7, we would have to wonder at his predictions.

9. There were only two separate contests other than the first and second games, and the scores instead of being 5 and 11 as predicted, were 9 and 7, with the Yanks scoring 8 to 1 in the first game and again scoring 4 to 3 in the second.

Now, giving Mr. Auberlin the benefit of the doubt in statement No. 2, of his first letter, and calling that statement half correct (a thing might just as well be totally incorrect, as only half correct) and further giving Mr. Auberlin 1/17th credit for accuracy in No. 7 and further crediting with No. 1, we find that the rating could not possibly be more than 10½ percent.

And let us remark here that Mr. Auberlin's predictions are far more accurate than any other definite prediction which we have received in the Astrology Contest. He uses no "perhaps"; he does not classify his statements with "ifs" and "possibly." The predictions are the types we desire, but alas for the accuracy! The reader can well imagine what others must be like if this is a sample of a really accurate one, at least insofar as predictions go. We desire to compliment the writer of the above letter at the present time for his zeal and earnestness in trying to bring to our attention something definite and concrete.—Editor.)



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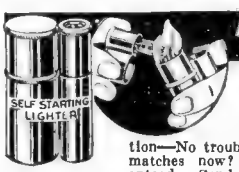

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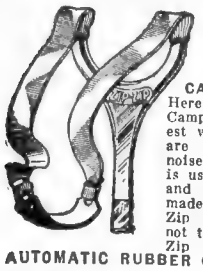

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If We Had No Ears!

By JOSEPH H. KRAUS

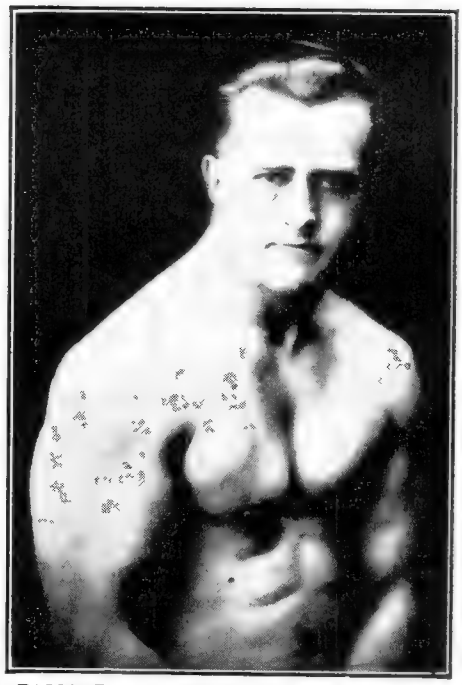
(Continued from page 704)

violin is totally different from that of a flute, piano, human voice or any other musical instrument.

It is known that we are able to record sound, and you will not dispute that we know how to perform this thing. Would you then say that our record is one of something which does not exist? We cannot conceive of a non-existing instrumentality producing or leaving a record. Of course, we do not directly record the sound in the ordinary way, but we record the vibrations of, either the moving body itself or of the air which is set in vibration by the body producing the sound. If sound did not exist, there could be no air vibration. Furthermore, some medium through which the sound can be conducted must likewise be present. A sound cannot be heard if the sound-producing object is in a vacuous space. Here again, it does not necessarily follow that no sound is being produced. We are quite confident that there is an intermolecular sound—a sound which is produced within the vibrating body and carried throughout the vibrating body. Our reason for this statement is that if you take an electric bell and place it in a vacuous space such as a bell jar, and fit that bell with a solid rod of metal, extending through an elongated tube formed in the side of the bell jar, under ordinary circumstances and when the bell jar is evacuated, no sound will be produced outside, but if the rod extending from the bell should be gripped with the teeth, then the sound will be distinctly heard. This would indicate conclusively that the object within the jar is producing a sound, even though we do not hear it.

Of course, there is a classical argument to this sound question. It is generally put in the following manner. If a tree were to fall on an uninhabited island, would it produce any sound? Just let us modernize that same question and make it, "If a bomb were to burst on an uninhabited island, would it produce a sound?" The questions are of course practically identical in the nature of the effects. Those who answer the question affirmatively have modern science to back them up. Those who take the negative side of the argument generally assume that sound is not produced unless it is heard by the human ear and in view of the fact that the human ear cannot hear the noise of the explosion, that sound is not produced. What nonsense. Were we to place a sensitive seismograph on the island, we could record the force of the explosion. We could tell that that explosion was caused by some force which detonated violently and which was different in reaction to any of the forces of nature. We could likewise place a phonograph on that island and record the sound produced. We could photograph both the explosion and the sound on a motion picture film, and reproduce it whenever desired. We could photograph the sound waves and their characteristics and we could further place a microphone and a wireless transmission station on the island so that all of the world could hear that sound.

There is, therefore, but one argument that we must further refute and that is, whether or not the human ear is a medium absolutely essential in the formation of sound. This has been answered before. Sound is chiefly objective, although it may also be subjective. Would any of our readers care to infer that no sound is produced because a deaf man cannot hear it? Suppose that we were all deaf and that all of our ancestors on this planet had been born deaf. Does that mean that sound is not produced? Those who take the negative side of the argument



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How do you shape up? Are you giving yourself a square deal? Have you got those big rolling muscles that mean health and strength inside and out? The vitality that gives you the ambition to win out at everything you start? Make that girl admire you first and foremost for a real he-man, and the hardest part in winning her is over.

I Can Give It to You in 30 Days

In 30 days I can do you over so that she will hardly know you. I'll put a whole inch of solid muscle on each arm in 30 days, and two whole inches of rippling strength across your chest. I've done it for over a hundred thousand others, and I can do it for you. I don't care how weak and puny you are. I like to get them weak and puny, because it's the hopeless cases that I work with best. It gives me a lot of real joy just to see them develop and the surprised look in their eyes when they step before the mirror at the end of 30 days and see what a miracle I have worked for them.

You'll Be a He-Man From Now On!

And it's no temporary layer of muscle I put on you. It's there to stay! With those newly broadened shoulders; that perfect neck and great, manly chest, you can maintain your self-respect in any society. Every woman will know that you are what every man should be—a forceful, red blooded he-man.

I Want You For 90 Days

If at the end of 30 days you think you have improved, wait till you see yourself at the end of 90 days. Then the friends you thought were strong will seem like children by comparison. I'm not called the Muscle Builder for nothing. My system scientifically builds real muscle faster than you ever imagined.

Watch Them Turn Around

Notice how every woman prefers the fellow who carries himself with head up. Notice how the broad-shouldered man always gets their eye. They want a dependable he-man when they make their choice—one who can protect them. **And you can be that man.** Remember, I not only promise it, I GUARANTEE IT.

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would say, "The sound is not produced." We could answer by saying "piffle", but that of course is not a grave enough argument. So we will swing into another analogy.

We cannot see the ultra-violet or the infra-red rays of light; neither are they discernible through any of our senses. We cannot see the X-rays; we cannot hear radio waves if transmitted from the antenna of a broadcasting station. Would any of our readers question the production of any of these? We definitely know that ultra-violet, infra-red, X-rays and radio waves are in daily use. We can demonstrate their presence by their action upon other receptors and in turn, we can visually see the action on those receptors. Why would this not be the case with sound? Why could we not see the sound through some agency such as a moving mirror, and, were we educated aesthetically enough, why could we not interpret those fluctuations in wave form and frequency, as well as in color, to satisfy even our present poor conception of sound quality.

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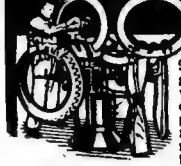

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Book Review

THE LAW OF CHEMICAL PATENTS, by Edward Thomas. Stiff cloth covers, 6¼"x9¼", 420 pages, published by the D. Van Nostrand Co., Inc., New York City. Price $6.00.

Ordinarily one would think that a book with such a dry title would be uninteresting, yet nothing is further from the truth. While this work deals primarily with the laws relating to chemical patents and points out those various chemical inventions which are and which are not patentable, it also covers the legal aspect of inventions. Treatment of such subjects as what constitutes a patent and what the federal courts have decided, of interesting situations and short concise case-histories in this book make it of value to anyone dealing with patents and particularly of course with chemical patents. The case-histories are indexed thoroughly. A complete list of industrial and legal terms as related to chemical patents appears and an index of the subject matter found in the book makes the work a constant handy reference. Careful attention to the contents of this book will inevitably benefit the inventive reader. That the subject could be so profusely covered from so many different angles in a work of this size is surprising. The book is to be thoroughly recommended to all inventors, attorneys and anyone desiring a knowledge of law as related to its titular subject.

SHOULD WE BE VACCINATED?, by Bernhard J. Stern. Stiff cloth covers, 5"x 7¼", 146 pages, published by Harper & Brothers, New York City. Price $1.50.

The addition of good books to the scientific field is increasing constantly. Many of these are small in size but their number is so great that they cover the subject thoroughly. The one here reviewed is a relatively small work, but it contains important facts on the subject of vaccination. The statements found therein cannot very well be disputed. The question of vaccination as a health problem is taken up in an easy style from the time of Jenner practically up to the present day. The history of vaccination and the results of the various investigations and decisions are then followed up to the point where vaccination makes its first inroads into the American medical field. Here, as in England, arguments appeared against it, but the factors in its favor were so great that vaccination became compulsory. Mr. Stern's figures indicate that in New York, where the population is greatest and where the sentiment against vaccination is not strong, the death rate from smallpox is fifty times smaller than in Minneapolis, where sentiment against vaccination is pronounced. Whether one is in accord with the idea of vaccination or prejudiced in the opposite direction, he should certainly read this lucid work.

MURDER IN FACT AND FICTION, by Canon J. A. R. Brookes. Stiff cloth covers, 6¼"x9½", 284 pages. Published by Brentano's, New York City. Price $3.50.

While this work is seemingly primarily intended to be a psychological study of murderers, and a chapter on the psychology of criminals does appear, it is primarily a series of typical histories followed up by a short chapter on suggestions for reform. Most of the murderers about whom Canon Brookes writes were English and it might have been of an advantage to have ventured upon the nature of the crime to a fuller extent because even American newspapers, bloody as some of them would like to be, have a sufficient number of murder mysteries to headline without paying the least attention to those occurring in foreign ports. Of course, some notable murder cases such as Landru and Smith are outlined in this work, but the psychological reasons for the murder are dismissed in just a few words. While the work left much to the imagination, and this reviewer felt decidedly dissatisfied with the author's concise conclusions, in justice to the book it must be said to have maintained interest throughout. There are many who will find this work of great value in comparing American crimes with those occurring in other lands, and in making comparisons of court and police procedures in punishing or apprehending criminals. The work is very well written.

HABITUAL CONSTIPATION, by Ismar Boas, M.D. Stiff cloth covers, 5"x7", 300 pages. Funk & Wagnalls Co., New York City. Price $2.00.

The successful treatment of habitual constipation is gradually being driven into the minds of the average layman, although the necessity of treatment was recognized by medical authorities many years ago. This work, a translation of a treatise by the famous Berlin medical authority, Dr. Boas, is well

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PRACTICAL RADIO CONSTRUCTION AND REPAIRING, by James A. Moyer, S.B., A.M., and John F. Wostrel. Stiff cloth covers, 5 x 7½ inches, 314 pages. Published by McGraw-Hill Book Company, Inc., New York City. Price $1.75.

This book aims to be of service to the amateur constructor who makes his own set and to the person who buys a complete radio receiving outfit and wants to know how it works and how to make minor adjustments and repairs when trouble is encountered. It will also prove valuable to the radio dealer who is called upon to test and repair radio receiving sets. Radio troubles are discussed in sufficient detail so that the radio repairman will be able to go about his work intelligently, systematically, and efficiently. The book gives easily understood information and directions about the construction, testing and repairing of the important types of receiving sets and commonly used radio equipment. Special attention is given to superheterodyne, short wave, impedance coupled and resistance coupled receiving sets. A full explanation and description of "trouble shooting" with illustrations and diagrams, and such difficult matters as fading and interference are fully discussed. A glossary, or dictionary of commonly used scientific radio terms has been included as an appendix.

THE LOGIC OF MODERN PHYSICS by P. W. Bridgman. Stiff cloth covers, 6 x 8¾ inches, 226 pages. Published by the Macmillan Company, New York City. Price $2.50.

One of the noteworthy movements in recent physics is a change of attitude toward what may be called the interpretative aspect of physics. The author gives us an understanding of the problem, which is really a double one, of understanding what we are trying to do and what our ideals should be in physics and of understanding the nature of the structure of physics as it now exists. These two ends are together furthered by an analysis of the fundamental concepts of physics; an understanding of the concepts we now have discloses the present structure of physics, and a realization of what the concepts should be involves the ideals of physics. The material for this book was largely obtained by observation of the actual current opinions in physics. On certain broad tendencies in present-day thought, the author has put his own interpretations. It is entirely possible that the stimulus of combating the ideas, offered in this book, will be of great value to the reader.

HENLEY'S TWENTIETH CENTURY RECIPES, FORMULAS AND PROCESSES by Gardner D. Hiscox, M.E., stiff cloth covers, size 6 x 9 inches, 800 pages. Profusely illustrated. Published by the Norman W. Henley Publishing Company, New York City. Price $4.00.

The publishers of this book have taken advantage of the cordial reception given to Henley's Twentieth Century Book of Recipes, Formulas and Processes and have added to this revised and enlarged edition many timely and much called for formulas, also a new chapter on laboratory methods containing many illustrations which will be found to contain information that will materially assist the experimenter in compounding the various recipes. The editor, in compiling this book, has endeavored to meet the requirements of the home and workshop. In revising the book many formulas were modified and processes of questionable merit were discarded. Much of the matter has been translated from foreign technological periodicals and books. In this way, the editor has embodied some practical information otherwise inaccessible to most English speaking people. Old recipes and so-called trading secrets which have proven their value by long use are also included, particularly where no noteworthy advances have been made; but the primary aim has been to modernize and bring the entire work up to the present date.

THE RELIGION CALLED BEHAVIORISM., by Dr. Louis Berman. Stiff cloth covers, 5¼ x 7¾ inches, 154 pages. Published by Boni & Liveright, Inc., New York City. Price $1.75.

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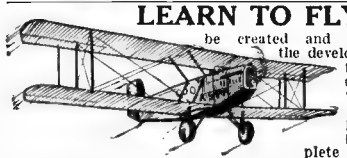

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CARTOON COMICS AND HOW TO DRAW THEM, by George Carlson. Stiff paper covers, size 8¾" x 11¼", 10 lessons, profusely illustrated. Published by the Carlson Cartoon Service, New York. Price $1.00.

In preparing these valuable cartoon lessons, the author has borne two things in mind. First, to get the greatest amount and most valuable instruction on this subject within a small space, and to prepare it in the most compact and attractive form, so that it will be well within the means of any student. With persistent application and practice and with the instructive possibilities that are in these lessons, the student will really be surprised at his own progress. Each lesson is illustrated with one page of drawings giving full details. These essential points in the work of an artist are, form, action and expression. These are given as much space as is possible. Technique and style are next taken up, and the last lesson is entirely given over to the elements of a comic picture. The prospective cartoonist will, without question, be benefitted by this course, and derive both pleasure and profit from it.

POPULAR CHEMISTRY, edited by J. Clinton Molitor. Paper covers, 6" x 9". Published by Popular Chemistry Co. Price 10c. per issue. $1.00 per year.

This issue of "Popular Chemistry" contains many interesting articles, the outstanding being Elementary Chemical Engineering, described by C. F. Miller. A section is devoted each month to Chemical Experiments, Chemical News and Chemical Questions. The amateur chemist will find much of interest between the covers of this little booklet and will profit by reading it. Back numbers of the magazine are available from the publishers who also have in stock many scientific and chemistry books which should appeal to the experimenter.

FIRST CROSSING OF THE POLAR SEA, by Roald Amundsen and Lincoln Ellsworth. 316 pages, illustrated. 6½"x 9½". Board covers. Published by George H. Doran Co., New York. Price $5.00.

The first part of the book is taken up with the trials and tribulations that the backers of the expedition underwent to raise money for the trip. This part of the book is the only tiresome portion, as it consists for the most part of credit being given to everyone concerned. The rest of the volume is written by different members of the crew of the *Norge* and deals with each individual's part.

The reader is first introduced to the dirigible in Italy before she was turned over to the Norwegians. The trip across Europe to Oslo, to Leningrad and thence to Spitzbergen, where the trip across the North Pole was started, is very well described. The thrilling part of the entire book of course, is the trip across the frozen wastes of the Polar regions; how flags of Norway, America and Italy were thrown from the *Norge* when they were immediately over the Pole! how they landed in Alaska; and the hearty reception they received on their return trip to Norway across the United States and the Atlantic. The remainder of the book is full of the technical details of the voyage and will prove a source of real information on polar flying. Radio, which played an important role on the trip, is fully described by the operator. The book is well worth reading not only for the excellent manner in which the voyage is described, but for the able way the technical details are presented.

BIRD'S EYE VIEW OF INVENTION, by A. Frederick Collins. Stiff cloth covers, 5½"x8", 314 pages. Published by Thomas Y. Crowell Co., New York City. Price $2.00.

An interesting feature of this book is that it gives in a somewhat summary style the early inventions in a number of branches of industry and science. This is very much to the point as it is these which have revolutionized the world. But it also comes down to recent date and it is quite interesting to find the curious engines and early reapers and the like illustrated. The work of Edison naturally receives much attention, and the models of early steamships are illustrated very interestingly. Space does not permit an adequate review of a book which seems only too short for the great field which it covers.

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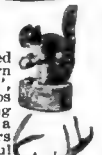

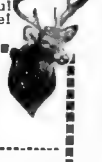

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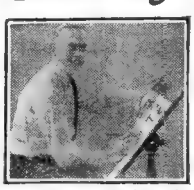

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FOGS AND CLOUDS, by Wm. J. Humphreys. Stiff cloth covers, size 5½"x8", 320 pages, 95 half tone illustrations. Published by the Williams & Wilkins Co., Baltimore, Md. Price $4.00.

In this volume the author has given us a system for specific cloud identification. The cloud photographs are especially interesting and instructive and have been taken in all parts of the world. The book should be of intense interest to artists, nature lovers, seamen and the like. To avoid confusion, the customary international classification of clouds has been used and to encourage the matching of the different types of clouds an arbitrary symbol, such as db, ac, and the like has been chosen. The first letter stands for the type of cloud and the second for the class. This symbol is given to each cloud represented in this book, in addition to its technical name. The first chapter of the book is devoted to a discussion of evaporation and precipitation, the second chapter to fogs, the next to cloud forms, the fourth to cloud miscellany and the last to cloud splendors. It is expected that this book will be gratefully received from many various sources and will take the place of a complete cloud standard and authority on this vastly interesting subject.

TROPICAL CYCLONES, by Isaac M. Cline. Stiff cloth covers, 5½"x8¾", 302 pages. Published by the Macmillan Co., New York City. Price $5.00.

These disagreeable visitors which have often done great damage to life and property are treated in this book, at least in the beginning, by study of individual storms, so as to accumulate a lot of illuminating data. After some 200 pages of this, a section is devoted to a summary and conclusions, followed by a bibliography. Storm tides are treated in an extensive appendix.

HYGEIA, by Burton Peter Thom, M.D. Stiff cloth covers, 4⅜"x6¼", 108 pages. Published by E. P. Dutton & Co., 681 Fifth Ave., New York City. Price $1.00.

This little work is devoted to the plague question, as we may call it, because it dives into the ancient history of communicable diseases. It is most interesting. It is impossible, as the book states to name the so-called plagues of the past because of the insufficient knowledge of those to diagnose them. The "Black Death" in the middle of the 14th century appeared in Europe after an interval of 700 years from its prior appearance, and it is said to have reduced the population of Europe by one-third. This is considered to be the Bubonic Plague. The author takes the ground that the plagues were not an unmixed evil, but operated to bring the laboring man forward and to democratize the world to a certain extent. The exclamation, "God Bless You," often heard when a person sneezes, is supposed to be a relic in the memory of this awful visitation when a sneeze was a symptom of the dread visitation. The little more than 100 pages of this book contain a great amount of data and information, and what we have said merely indicates its method of treatment.

INSECTS, by Glenn W. Harrick, stiff cloth covers, 5¼"x7¾", 478 pages, profusely illustrated. The Macmillan Co., New York City. Price $3.00.

An exceptionally complete work is this one on household insects. It covers so many different household pests that in this short review it would be difficult to analyze them. We find all kinds of flies, mosquitoes, bed-bugs, cockroaches, fleas, ants, insects injurious to clothes and carpets, cereals, foods, meats, cheese and other troublesome invaders of the household; human parasites, annoying pests and the woodboring and poisonous insects itemized in the book with a complete critical study of each and the methods of exterminating them. It it written in popular style and can be understood by either child or adult. The method of how the exterminating systems work are completely covered in such detail that the book can be considered among the finest of its kind. The latest investigations are incorporated in this new and revised edition, such as the recent work on the cluster fly, in which it was found that it passes its early stages in earth worms; the substances in the most recent insecticides are given in the book so that the reader can prepare his own or can do whatever exterminating he may desire and know that he will be successful if he continues with his battle long enough.

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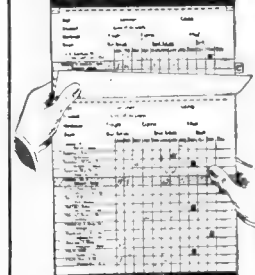

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Our Part in Ruth Elder's Flight

(*Continued from page 723*)

These suits have a weight of three pounds attached to each leg to keep the wearer in an upright position, and they are warm enough to enable the wearers to keep them on for days, even in icy waters.

Science takes a hand in trying to safeguard the lives of long distance fliers if they will but heed the call. For example Dr. James H. Kimball of the New York branch of the U. S. Weather Bureau, prepared the chart, marking the low pressure area in the Atlantic, and it was around this area that Capt. Haldeman had to fly in order to escape the storm.

This flight is epochal in two respects. It is the longest flight over water ever made. Miss Elder and Capt. Haldeman covered a distance of 2,574 statute miles on the great circle course, to the point where they were picked up. Their actual flight, due to their attempts to get around the storm area, was probably much longer. It is also the longest flight ever made by a woman. The mishap brought about the narrowest rescue since Harry Hawker came down in the sea alongside of a ship on the first attempt to fly across the Atlantic.

With individual life suits which can be worn without discomfort, and which contain a pouch for food and water, the inconveniences of trying to pull out a life raft from its storage place in the fuselage are completely counteracted. It requires time to inflate a life raft, but it requires very little time to step out of the plane, or cut one's way out of the plane and step into the water with the individual life suits.

A portable radio transmitter was so arranged that it would float on the surface of the sea. It was suggested that this be equipped with rubber balloons for aerial support, and a gas tank for inflating the balloons. The reason is that the sticks required for the erection of the kite are approximately six feet long. It may be difficult to get these out of a plane, and the sticks might likewise be broken up in handling them. When rubber balloons are used, a suitable supply in a pouch could be attached directly to the side of the transmitter, and the gas for inflation could also be located on the transmitter or on the back of one of the aviators. This emergency equipment with a range of thirty-five miles on land, and perhaps seventy-five or more miles at sea, is of incalculable value. The balloons would rise in any ordinary kind of weather. They are not as difficult to manipulate as the kite, even though subjected to other questionable setbacks, such as possible rupture and leakage of gas supply.

A radio transmitter constantly sending out both the plane call signal, and any information concerning the plane will enable the world to keep in touch with the fliers. Ships at sea can locate the plane by radio compass bearings, even though the plane is not in sight. Commander Byrd demonstrated his constant contact with the world by means of this automatic transmitter. It was unfortunate that the radio compasses were not able to give him his location.

Science and Invention played no small part in not only suggesting, but also assisting in the actual arrangements of the flight of The American Girl. There came to the offices of this publication one day, a gentleman by the name of Stanley Yale Beach, the secretary of the Aero Science Club, which club, by the way, is still busy trying to locate those illustrious aviators Nungesser and Coli. He asked us for suggestions concerning the flight of The American Girl, and particularly for any information which we could give him insuring the safety of Ruth Elder and Capt. Haldeman. He told us

(*Continued on page 772*)

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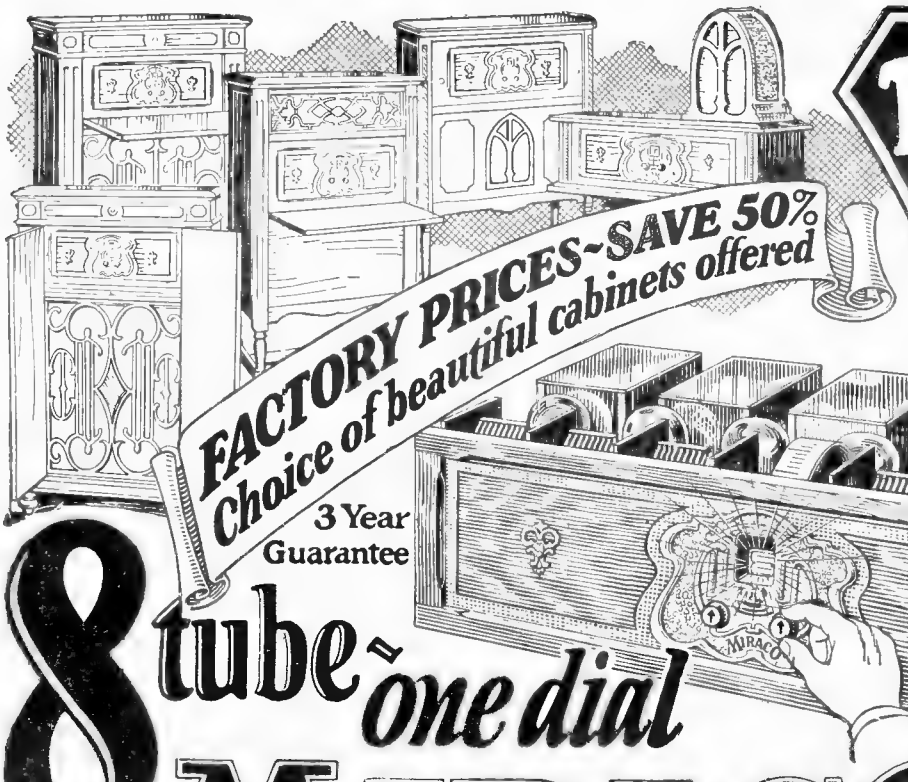

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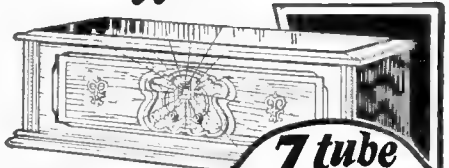

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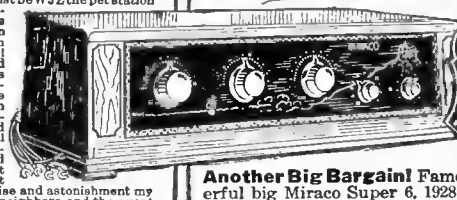

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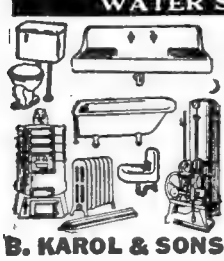

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Our Part in Ruth Elder's Flight

(Continued from page 769)

that he was already contemplating the use of the self-contained life suits made by the National Life Preserver Co., which are depicted in our illustration. Suggestions were met with arguments pro and con, and finally it was decided that the best possible arrangement would be to equip the plane with either a short-wave or a 600 meter transmitter. This transmitter was to be actuated automatically, constantly sending out anyone of five signals, permanently inscribed on discs of metal. Coincidentally, it was argued that it would be a good idea to drop empty 20 gallon gasoline tanks along the course to mark that course.

Then, there must be an emergency radio equipment. Both the suits and the emergency equipment were decided upon by the fliers, although the regular transmitter which would have enabled the world to keep in touch with the plane was discarded because of its weight of 50 pounds. This would mean a few more gallons of gasoline. Even the argument that gasoline was of no value if they came down at sea could not be overruled.

The emergency equipment was built by the D. Allen Cardwell Mfg. Corp. It is contained within a box so arranged that the box would float. All of the equipment is water-tight. The special buzzer is operated by Burgess batteries and connected through condensers and spark gap with a pancake inductance, inductively coupled with a second. Six feet of wire and a metal plate enable the transmitter to be used in event that the plane comes down on the surface of the sea. A 250 foot antenna is sent aloft by a waterproof kite, 6 feet long, the kite being of the Eddy or tail-less type. This kite can be floated on the surface of the water and then the wire jerked, raising the kite from the crest of a wave. While not much more suitable than the balloons, the equipment weighed less. The buzzer transmitter is operated through a rubber diaphragm under which the key is placed. A meter indicates when the transmitter is working. The complete transmitter, kite and all equipment weighs 14½ pounds.

It is difficult to determine why the aviators did not don their life-buoy suits, when they took off. Capt. Haldeman suggested that they would have ample opportunity to get into the suits in event of accident, inasmuch as they intended to fly at 15,000 feet from which height they could volplane down in five minutes, whereas it takes but one minute to get into the suit and lock it in place.

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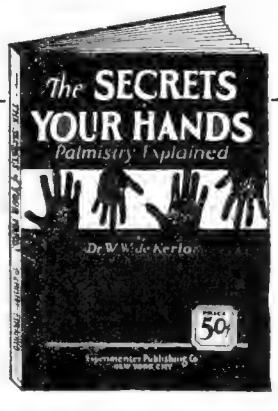

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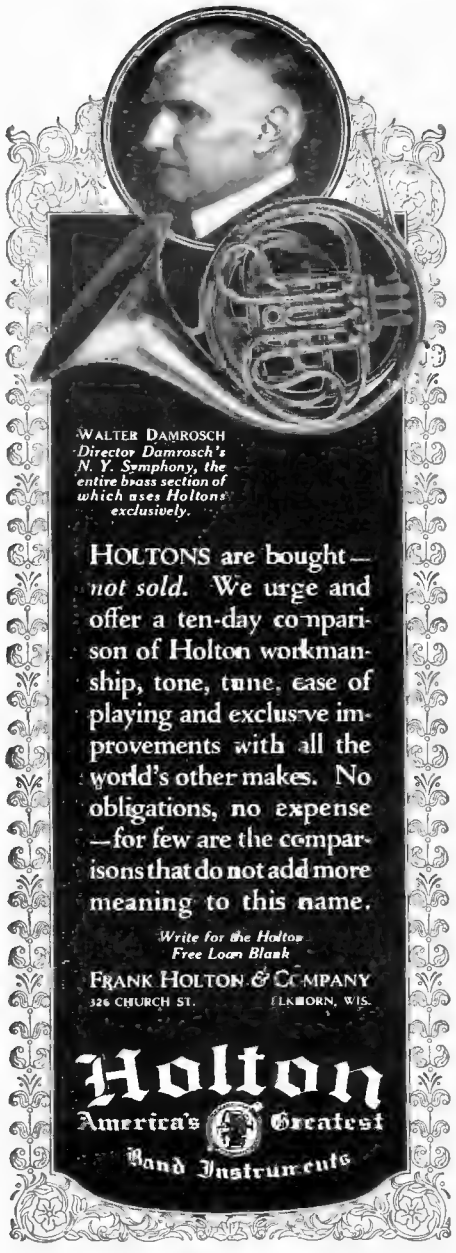
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State of New York, } ss.
County of New York, }

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of SCIENCE AND INVENTION, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Experimenter Publishing Co., Inc., 230 Fifth Avenue, New York, N. Y.; Editor, Hugo Gernsback, 230 Fifth Avenue, New York, N. Y.; Managing Editor, H. Winfield Secor, 230 Fifth Avenue, New York, N. Y.; Business Manager, Charles E. Rosenfelt, 230 Fifth Avenue, New York, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) The Experimenter Publishing Co., Inc., Hugo Gernsback, Sidney Gernsback, R. W. DeMott, H. W. Secor, Dr. T. O'Conor Sloane, I. S. Manheimer—all of 230 Fifth Avenue, New York, N. Y.; Mrs. Catherine Major, 545 West 158th Street, New York, N. Y.; M. M. Finucan, 720 Cass Street, Chicago, Ill.; L. F. McClure, 720 Cass Street, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

H. GERNSBACK, Editor.

Sworn to and subscribed before me this 30th day of September, 1927.

[SEAL.] JOSEPH H. KRAUS.

Notary Public, Queens County Clerk's No. 985, Queens County Register's No. 2903, New York County Register's No. 9267, New York County Clerk's No. 317. (My commission expires March 30, 1929.)

A Third Dimensional Movie Screen

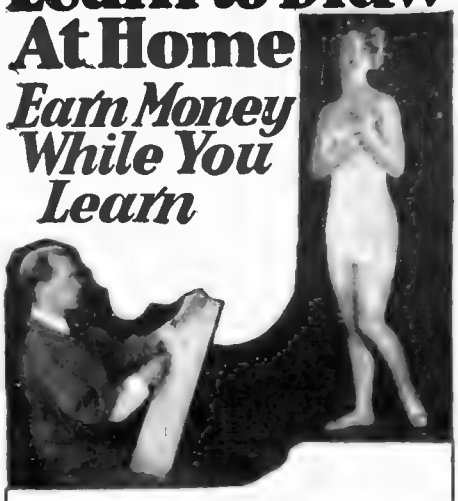
(*Continued from page* 705)

rent. This means a saving of current of about $2,000 a year for the larger moving picture houses. The screen at the Roxy is 24′ 8″ wide and 18′ 6″ high and weighs about 350 pounds, slightly more than the ordinary projection sheet. It is perfectly flexible, non-inflammable and may be washed. It is possible to roll the screen on a roller 2″ in diameter. Inasmuch as it is unaffected by humidity or weather changes, it is suitable also for exposed outdoor projection.

—*J. Rubenstein.*

HAVE YOU SENT IN THAT FAVORITE SHOP KINK YET?
See page 719

Learn to Draw At Home
Earn Money While You Learn



$100 a Week
Earned By Young Artist

"I am earning $100.00 a week" writes our graduate, P. C. Roberts, Fla. "Pretty good for a young man of twenty."

Graduate Wm. R. Kent, New Jersey, writes: "I have obtained $100.00 for a single drawing which only took a day to do."

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Earn While You Learn

This course teaches you how to draw "pictures that sell," while learning. E. V. Fritsch, Texas, who had completed only one-third of the course, wrote: "I earn $10.00 to $15.00 a day." Miss H. H. Hartleigh, Mass., writes: "I have made $235.00 and I've only sent in 12 lessons." David W. Gould, Maine, wrote, while learning: "I made $225.00 on one job."

Opportunities Everywhere

Over 50,000 Buyers of Drawings everywhere; such as over 4,000 Advertising Agencies; 12,000 Large Advertisers; 2,500 Newspapers; 2,400 Magazines; 25,000 Printers; 1,100 Book and Music Publishers; 700 Photo-Engravers; 3,000 Department Stores; 5,000 Art Stores. Retail Stores also use drawings for advertisements and display cards. No need to leave home—hundreds of buyers probably in your own section. And you can mail drawings to distant buyers.

What Art Buyers Say

An Art Editor writes: "Please furnish names of students in this vicinity." Another writes: "Advise a few of your best students to send us samples." A Magazine Publisher writes: "We are buying drawings from your graduates and undergraduates."

Send For Free Book

Handsomely illustrated free book tells how you can learn at home this way. It tells what our graduates earn; how they earned while learning. Tells of big markets for drawings and how our Students' Service Bureau operates to help capable students to sell drawings or obtain a position. Carl C. Thompson writes: "Through your aid I have been offered 25 different positions." Book is free. No obligation. No salesman will call. Mail coupon today.

"Born" talent not needed. This remarkable method has taught many who had never drawn before. You, too, can learn.

Washington School of Art, Inc.
Room 2612-E, 1115 15th St., N. W.
Washington, D. C.

Washington School of Art, Inc.
Room 2612-E, 1115 15th St., N. W., Washington, D. C.

Please send me without cost or obligation your book, also details of your offer to new students.

Name .....
(Please write plainly. Mr., Miss or Mrs.)

Address .....

City ..... State .....

Please state age .....

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the February issue must reach us not later than December 5.

EXPERIMENTER PUBLISHING CO., INC., 230 Fifth Avenue, New York, N. Y.

Agents Wanted

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Send name, address on postcard. Free introductory copy Salesology Magazine; contains 1000 money making opportunities offered by big reliable firms; no obligation. Salesology Magazine, Desk B-219, 500 No. Dearborn, Chicago.

"Superkeen! Amazing new patented magnetic blade sharpener! Sharpens all razor blades instantly, magically, by powerful magnetic force! New! Absolutely different! Sensational demonstration! Whirlwind Seller! Write for pocket sample!" SuperKeen, Dept. B-15, Salisbury, N. C.

Don't sell for others. Employ agents yourself. Make your own products. Toilet Articles, Household Specialties, etc. 500% profit. We furnish everything and show you how. Valuable booklet free. Write at once. National Scientific Laboratories, 1907W Broad, Richmond, Va.

Great neckwear line now free! Features finest quality neckwear at factory prices. Collect big commissions daily. Write for FREE tie offer and FREE outfit. Nawco Neckwear, Desk CZ-115, Covington, Ky.

Lindale polishing cloth shines and polishes all metals simply by rubbing. Price 25 cents. Agents wanted. Good profits. Free sample. Lindale Manufacturing Co., 138-27 Lloyd Rd., Jamaica, N. Y.

New Invention—100% profit.. Liquid quick mend for Fabrics and Hosiery. Stops runs. Every woman buys. Hundred other fast sellers. J. E. Johnson Co., Dept. 859, 6129 Wentworth, Chicago.

Earn $10 daily silvering mirrors, plating, refinishing metalware, headlights, chandeliers, bedsteads. Outfits furnished. N. Decie Laboratories, 225 Varick St., New York.

Agents: Make $500.00 monthly. Pay daily. No investment. Rhinestone Initial Buckles and Novelties. Sell easy everywhere. Exclusive territory. CHATON NOVELTY CO., 606 Blue Island, Chicago.

Agents, for big quick profits try our new adjustable waterproof aprons; 100% profit. B. & G. Rubber Company, Dept. 276, Pittsburgh, Pa.

Big money easily made without peddling or outfits. Free particulars. E Elite, 38E Elizabeth St., N. Y.

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Rummage sales make $500.00 monthly. We start you furnishing everything. Experience unnecessary. Monarch, Desk 4, 609 Division, Chicago.

We want Direct to Consumer salesmen or agents in every community for our Magnetic Trouble Lamp—BRITE-LITE—the fastest selling auto necessity in the world—retails $3. BRITE-LITE sells itself on sight—agents make big money. National sales force now being organized. Here is a chance to join a live organization and have exclusive territory. Send details of your past experience and a BRITE-LITE will be mailed with full information. Address NATIONAL ELECTRIC CORPORATION, P. O. Box 90, Dept. E, Newark, N. J.

Just Out—New Patented Apron. No strings or straps—$20.00 a day every day; over 100% profit; commissions daily. Write for free offer. Sta-Put Co., Dept. 512, St. Louis, Mo.

We Start You—Silvering mirrors; plating tableware, autoparts, headlights, etc.; refinishing metalware, chandeliers, bedsteads, etc. Immense profits. Outfits furnished. WESCO, B-1216, D, Wichita, Kans.

You Are Wanted to Resilver Mirrors at Home. Immense profits plating autoparts, tableware, etc. Write for information. SPRINKLE, Plater, 955, Marion, Indiana.

We Start You in Business, furnishing everything; men and women, $35.00 to $100.00 weekly operating our "New System Specialty Candy Factories." Few dollars start you home or small room anywhere. Booklet free. W. HILLYER RAGSDALE, Drawer 129, East Orange, N. J.

Agents—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Philadelphia, Pa., Dept. 601.

$60—$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

Make Money Silvering Mirrors, refinishing auto headlights, tableware, metal plating, bedsteads, chandeliers. Outfits furnished. International Laboratories, Dept. 69, 309 [illegible] Ave., New York.

[illegible]ney and fast sales. Every owner buys gold initials for auto. You charge $1.50; make $1.35. Ten [illegible]. Write for particulars and free samples. [illegible] Co., Dept. 71, East Orange, N. J.

[illegible]plying Gold Initials on Automobiles. $1.45 profit every $1.50 [illegible]nograms", R1043, Wash-

Signs. No ex-[illegible]idated, 69-R-

yourself. [illegible]atalog,

Agents Wanted (continued)

Make $25.00 daily selling colored Raincoats and Slickers, Red, Blue, Green, etc. $2.95—Hat Free. Commissions daily. Outfit FREE. Elliott Bradley, 241 Van Buren, Dept. AD-12, Chicago.

Advertisers and Distributors

Earn $8. Distribute 400 free Samples Stopleak Rivets. Send 6c stamps for samples and secure territory. Riveet Co., Cohoes, N. Y.

Advertising Agencies

24 words—355 Rural Weeklies $14.20. Ad-Meyer, 4112-SI Hartford, St. Louis, Mo.

Advertise 50 Magazines $4.00 inch, thrice $8.00; circulation proven. KING, Box 672-I, Wilmington, Delaware.

Airplanes, Aviation

Send dime for 12 inch mounted propeller and circulars on free three foot model aeroplane. No selling. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich.

Biggest, Best Catalog Model Airplanes, Parts, Supplies; 5c postpaid. Ideal Company, 169½ Spring Street, New York.

Airplanes—Send for free cuts and Plans of our wonderful two Place, Companion type, small, high life wing monoplane, and information, How to build this ship, and be sure it will fly, also Propeller literature. Crawford Airplane Manfgr., 2225 American Ave., Long Beach, Calif.

Model Airplane Engines: ½ h. p. in 3 lbs.; 1 h. p. in 5 lbs. Stationary Engines: ½ h. p. in 10 lbs.; 1 h. p. in 15 lbs. Circulars free. DYNAMIC MFG. CO., First Nat'l Bank Bldg., Chicago.

Battle Photos and War Relics

For Dens: Relics from Europe's battlefields (also medals) illustrated catalogue with sample war photos 25c. International, 1889 Albany Ave., Brooklyn, N. Y.

Books

Hypnotism Wins fame, fortune, etc., 25 easy lessons and 218-page illustrated reference guide $2.00. "Mindreading" (any distance), wonderful, $2.00. Science Institute, SI-130 Milwaukee Avenue, Chicago.

Magic—Tricks, Books and Supplies. For Amateurs as well as the great professionals. Anyone can learn with our tricks and instructions. Send 10c today for large catalogue. Sterling Magic Shop, Box 33, Danville, Va.

Free—My Illustrated Circulars on Newthought, Selfculture, Healing, Yogi Philosophy, Occult, Mystic and Scientific Books. Martens Publisher, Inc., Burlington, Iowa.

The Boy Electrician. Pocket size, 75 illustrations, 25c. J. Tillberg, Proctor, Vermont.

Books, Magazines, Art Publications, in English, French, Spanish. Photo novelties, etc. Catalog free. Villaverde Co., Box 1329, Havana, Cuba.

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Print 250 Signs or Pictures an hour without press, type or machinery. Sample and particulars 10c. Straco, 1015½, Springfield, Ohio.

Manufacturer with sales organization reaching principal cities in U. S. and Canada, desires additional articles of merit to manufacture and sell—either on royalty or outright purchase—in Builders Hardware and Electrical Appliances. Letters and papers treated with confidence. Address H. L. Cook, Aurora, Ill.

Sell by Mail. Free literature tells how. Mason, 3902 Broadway, Room 6, Chicago.

Receive mail from everywhere. Mail order propositions, Magazines, Your name listed, 20c. Larson Bros., 3110 North Avenue, Chicago.

Gift Novelties. Holiday sellers! Circulars, 2c. Housinger, 8236 Cornell, Chicago.

You, too, can make money selling by mail. Free literature tells how. M. Donlon, Box 99, Floral Park, N. Y.

Make Money from Your Ideas or Patents—Will buy or manufacture on royalty, new ideas or patents. Toys, Novelties, Useful Devices, preferably which can be made mostly of small wooden pieces or veneer. What have you? Burnahm Lumber Co., Richland Center, Wis.

Cameras and Photography Supplies

Make money in Photography. Learn quickly at home. Spare or full time. New plan. Nothing like it. Experience unnecessary. American School of Photography, Dept. 5332, 3601 Michigan Avenue, Chicago.

Chemistry

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 686 of this issue. Chemical Institute of New York, 16 E. 30th St., New York City.

Chemistry (continued)

Solubility chart free. See POPULAR CHEMISTRY ad on page 755.

Amateur Chemists. Build your own Laboratory. We furnish the chemicals. Send for our Price List. A. Hotaling, 23 Melrose Avenue, East Orange, N. J.

Special offer to experimenters. 50 different chemicals, generous quantities of each. Price $3.50. 25 pieces of chemical apparatus of high quality. Price $3.50. Money order, C. O. D. or cash postpaid. Pines Chemical Co., 1524 St. Marks Ave., Brooklyn, N. Y.

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Used correspondence school courses sold on repurchase basis. Also rented and exchanged. Money-back guarantee. Catalog free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Home Study—Engineering, Bookkeeping, Higher Accountancy, High School, and other courses. Write Carnegie College, Rogers, Ohio.

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Electric Fun! Seventy stunts, 110 volts, $1. Cuttingco, Campbell, Calif.

For Inventors

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 808 Jenifer Bldg., Washington, D. C.

Patents Obtained under cooperative payment plan. Write for particulars. W. E. Beck, Registered Patent Lawyer, 953 Jenifer Bldg., Washington, D. C.

Formulas

500 Formulas and Big Catalog 20c. Ideal Book Shop (N), Park Ridge, Ill.

Help Wanted

Men, get Forest Ranger job; $125-$200 mo. and home furnished; permanent; hunt, fish, trap. For details, write Norton, 265 Temple Court, Denver, Colo.

Firemen, Brakemen, Baggagemen (white or colored), sleeping car, train porters (colored). $150-$250 monthly. Experience unnecessary. 897 Railway Bureau, East St. Louis, Ill.

Men-Women, 18 up. U. S. Government Jobs. $1140 to $2200 year. Steady, pleasant work. Paid vacation. Short hours. Experience unnecessary. Common education sufficient. 25 coached FREE. Write today sure for list positions and full particulars. Franklin Institute, Dept. S16, Rochester, N. Y.

Men-Women, 18 up. Get U. S. Government Life Jobs, $1140 to $3300 year. Steady work. Many Railway Mail Clerks—Clerks—Carriers, appointed every year. Inside and outside work. Experience unnecessary. Common education sufficient with our coaching. List positions and full particulars—FREE. Write today sure. Franklin Institute, Dept. S4, Rochester, N. Y.

Government Forest Rangers, Meat Inspectors, Patrol Guards, Special Agents, Mail Clerks, Chauffeur-Carriers needed often. $125-$250 month. "How to Qualify" mailed free. Write. Ozment, 293, St. Louis, Mo.

Men Wanting Outdoor Work, qualify for forest ranger position. Start $125 month; cabin and vacation; patrol the forests, protect the game; give tourists information. Write Mokane, Dept. M-34, Denver, Colo.

Silvering Mirrors, French plate. Easily learned, immense profits. Plans free. Wear Mirror Works, 16 W. Excelsior Springs, Mo.

Detectives Earn Big Money. Travel. Excellent opportunity. Great demand everywhere. Experience unnecessary. Write, American Detective System, 2190 Broadway, N. Y.

Distributors—No canvassing, no capital. Honery, Roseto, Pa.

Be a Detective. Work home or travel. Experience unnecessary. Particulars free. George Wagner, 2190 Broadway, New York.

How to Entertain

Plays, Musical Comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogs, recitations, entertainments, music readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 99, Chicago.

Instruction

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemists. See our ad on page 686 of this issue. Chemical Institute of New York, 16 E. 30th St., New York City.

Make Your Own Banjo. Educational and instructive little book tells all. Price $1.00. J. Cominskey, 345 8th Street, Ann Arbor, Mich.

Inventions Wanted

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Will buy approved invention. Write W. L. Kendig, 416 N. Duke Street, Lancaster, Pa.

Machinery and Tools

Concrete Building Block Machines and Molds. Catalog free. Concrete Machine Co., 5 N. First St., St. Louis, Mo.

Magic and Games

Free with $25 order our large die box. Send 20c for our large catalogue of tricks, puzzles, wigs, sensational escapes. Oaks Magical Co, Dept. 549, Oshkosh, Wis.

Manuscripts—Short Stories Wanted

Earn $25 weekly, Spare time, writing for newspapers, magazines. Experience unnecessary. Details Free. Press Syndicate, 987, St. Louis, Mo.

Make $25 Weekly at home, spare time, writing short stories for photoplays. Experience unnecessary. Outline free. Producers League, 603, St. Louis, Mo.

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Beautiful Registered Bull Pups, $15. Bulldogs, 501 Rockwood, Dallas, Texas.

Forms to cast Lead Soldiers, Indians, Marines, Trappers, Animals, 151 kinds. Send 10c for illustrated Catalogue. H. C. Schiercke, 1034-72nd St., Brooklyn, N. Y.

100 Genuine Indian Arrowheads from Arkansas. $4.00 postpaid. H. Daniel, Lamar, Ark.

Be Independent. Receive 100 letters a day containing 25c. and give a dollar article to every customer. Send 25c. for dollar article and complete plan. No fake. Dept. 2, Western Mailing Service, 1636½ E. 6th Street, Long Beach, Calif.

Hunting Hounds Cheap; trial. Dixie Kennels, B7, Herrick, Ill.

Underground Treasures. Simple, scientific method for locating explained free. T. Santschi, Glenellyn, Ill.

Attention Builders and Cement Workers—Diamond granite a new invention. Sparkles like diamonds. Harder than genuine granite. Cheaply manufactured. Sample 24c. Complete instructions $2.00. Guaranteed. F. D. Gibson, 8 Eden Park Terrace, Cincinnati, O.

Blue Prints. Make Your Own Hookups, photographs, etc. Materials and one sq. yd. of sensitive paper 50c. With three sq. yds. $1.00. Novelty Print Co., 4745 East 94 St., Cleveland, Ohio.

Business Openings Investigated, any town Nebraska $2.00. State Bureau, Box 709, Omaha.

Models and Model Supplies

Ship Model Fittings: Steering wheels, Capstans, Anchors, Propellors. Send for booklet. A. J. Fisher, 1002 Etowah Ave., Royal Oak, Michigan.

Motorcycles—Bicycles

Motorcycle Bargains. Used, rebuilt. Guaranteed shipped on approval. Catalog free. Floyd Clymer, 812 Broadway, Denver, Colo.

Moulds

Moulds Making Toys. See ad on page 775. Miscellaneous. H. C. Schiercke.

Musical Instruments

Violins—Deep, Mellow, Soulful—on easy credit terms. High grade, wonderful instruments of my own make. Development of many years' experience. Write for book. Gustav A. Henning, 2424 Gaylord St., Denver, Colo.

Old Coins

California Gold, quarter size, 27c; half-dollar size, 53c. Columbian nickel and catalogue, 10c. Norman Shultz, Box 746, Salt Lake City, Utah.

Old Money Wanted

$2 to $500 Each paid for hundreds of Old or Odd Coins. Keep all old money, it may be very valuable. Send 10c for new illustrated Coin Value Book, 4x6. Guaranteed Prices. Get Posted, we pay Cash. Clarke Coin Company, 14 Street, LeRoy, N. Y.

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Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 212 Victor Bldg., Washington, D. C.

Richard E. Babcock, Patent Lawyer, Washington Loan & Trust Bldg., Washington, D. C., Booklet.

Monroe E. Miller, Guray Bldg., Washington, D. C. Patent Lawyer, Mechanical, Electrical Expert. Booklet and Priority Record blank gratis.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, free schedule information free. Lancaster and Allwine. Registered Patent Attorneys in United States and Canada, 242 Ouray Bldg., Washington, D. C.

Patents Procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 41-T Park Row, New York.

Patent Attorneys (continued)

Patents. Send for free booklet. Highest references. Best results. Promptness assured. Send model or drawing for examination and advice. Watson E. Coleman, Patent Attorney, 724-9th Street, N. W., Washington, D. C.

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"Inventor's Advisor," Valuable Patentbook sent free. Labiner, 3 Park Row, New York.

Patent, Trade-Marks, Copyrights. Reliable services by an experienced practitioner devoting personal attention to each case. Inquiries invited. References furnished. B. P. Fishburne, Patent Lawyer, 525-D McGill Building, Washington, D. C.

Patents obtained under Co-operative Payment Plan. Write for particulars. W. E. Beck, Registered Patent Lawyer, 952 Jenifer Bldg., Washington, D. C.

Get your own patents. Forms, complete instruction $1 Cuttingbros, Campbell, Calif.

ADAM E. FISHER, Registered Patent Attorney, in business 25 years; references; personal attention and promptness assured; Dept. E, 205 Enright, St. Louis, Mo.

"Inventors' Guide" free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Ledermann, Registered Attorney and Engineer, 17th Floor, Woolworth Bldg., New York.

Patents. Free advice, personal service of registered Attorney, former Patent Office Examiner. Booklet. Albert Jacobs, 728 Barrister Bldg., Washington.

Patents Secured. Easy terms. Inventors Service Bureau, Box 1648, Washington.

Patent Sense—As one of the oldest firms in America we give inventors, at lowest consistent charge, a service noted for results, evidenced by many well-known Patents of extraordinary value. Book, Patent-Sense, free. Lacey & Lacey, 644 F St., Washington, D. C. Estab. 1869.

Patents

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Patents Wanted

Inventions Commercialized. Patented or Unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Mr. Inventor—If you have a patent or invention for sale, write Hartley, 38 Court St., Bangor, Me.

Patents for Sale

For Sale—Copyright 896,851, New Game. Address Box 266, Fostoria, Ohio.

Photography

Have you a Camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 118 Camera House, Boston, 17, Mass.

Transfer Photographs to metal, china, etc. Patented process. Makes beautiful miniatures. A real art. Lots of fun and profit. Anyone can do it. Outfit supplied to members only. Write about membership. Kyograph Photo System, 21-D W. 17th St., New York.

Photoplays Wanted

$$$ For Photoplay Plots, Stories accepted any form, revised, criticised, copyrighted, marketed. Estab. 1917. Booklet free. Universal Scenario Co., 223 Western & Santa Monica Bldg., Hollywood, Calif.

Printing Outfits and Supplies

Print your own cards, stationery, circulars, paper, etc. Complete outfits $8.85; Job Presses $11, $29; Rotary $149. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Kelsey Company, F-6 Meriden, Conn.

200 Letterheads and 100 Envelopes, $1.00, postpaid. OBERMAN COMPANY, Box 1268, Chicago.

Radio

Transformers for A.C. tubes $3.50. Chokes 30H $2.50. Heavy Duty 100H-125 MA $5.75. Write for lists. Radio Parts Sales Co., Orange, N. J.

Radio Equipment

Direct Factory Sale. Wholesale prices. Tremendous Savings. Selling direct to you. Here are some of our many items: 30 Henry Choke, 100 M.A. $2.19; 10 Henry Choke, 400 M.A. $5.48. Power Transformers for all kinds of Eliminators and for all types of A.C. Tubes at Special Low Prices. EVERY ITEM FULLY GUARANTEED. Promptly shipped upon receipt of order. Send for free illustrated catalog today. Todd Electric Co., Inc. (Manufacturers), 36 West 20th Street, Dept. B, New York City.

Salesmen Wanted

66 Miles on 1 Gallon—Amazing New Moisture Gas Saver. All autos. 1 Free. Critchlow, B-863, Wheaton, Ill.

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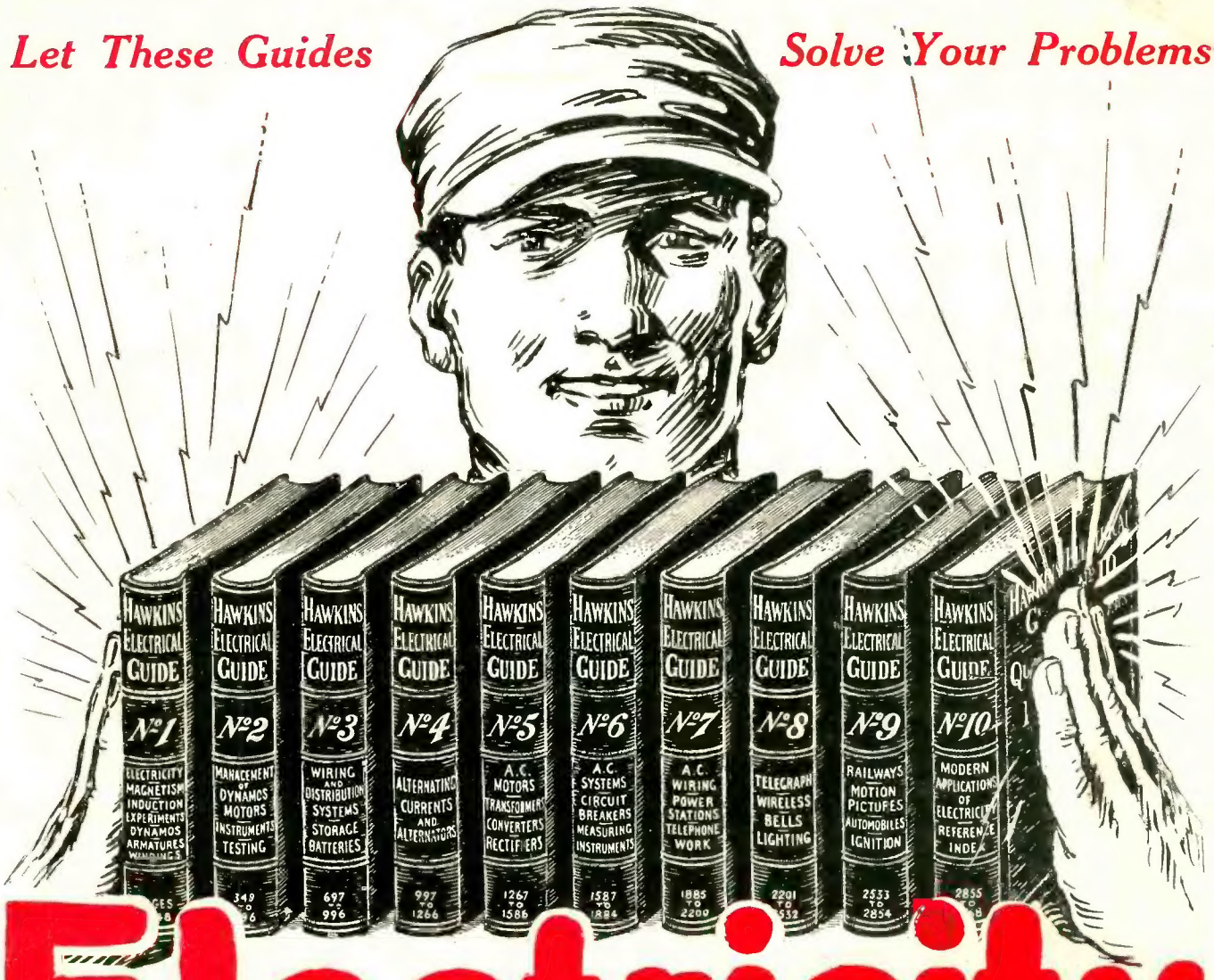

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